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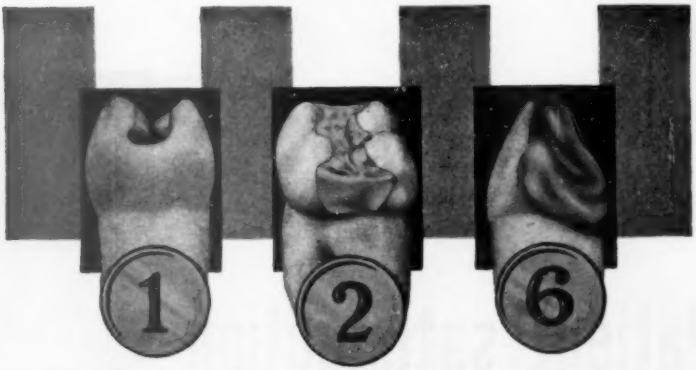

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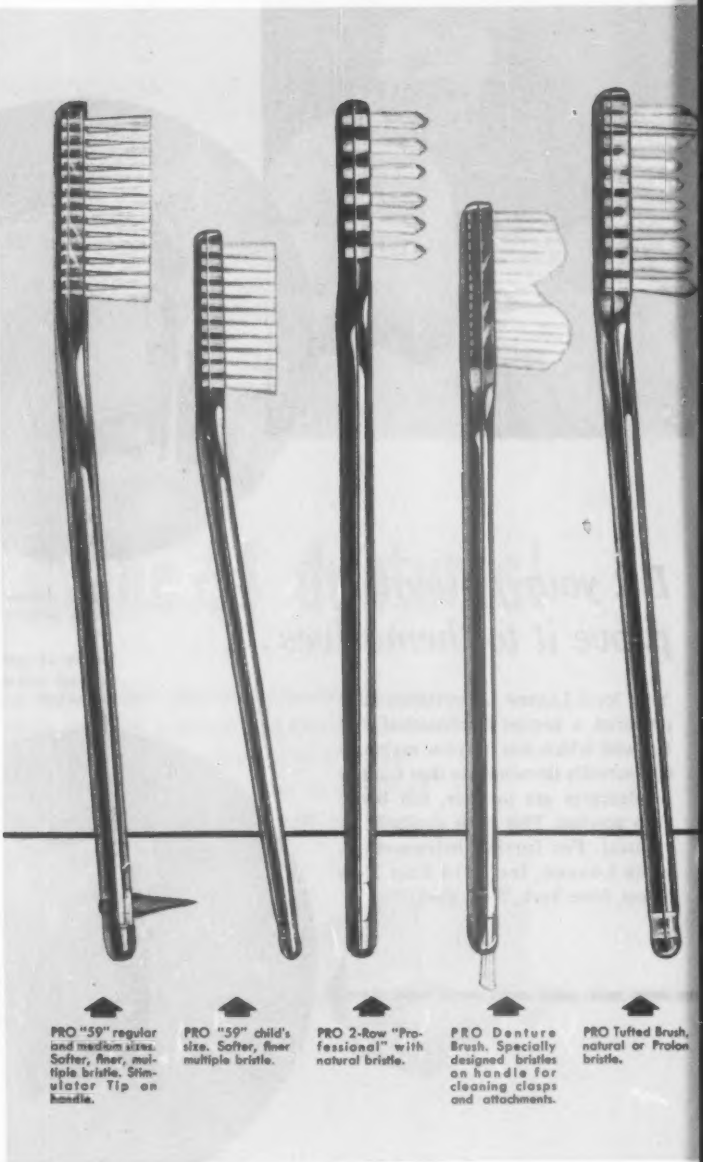

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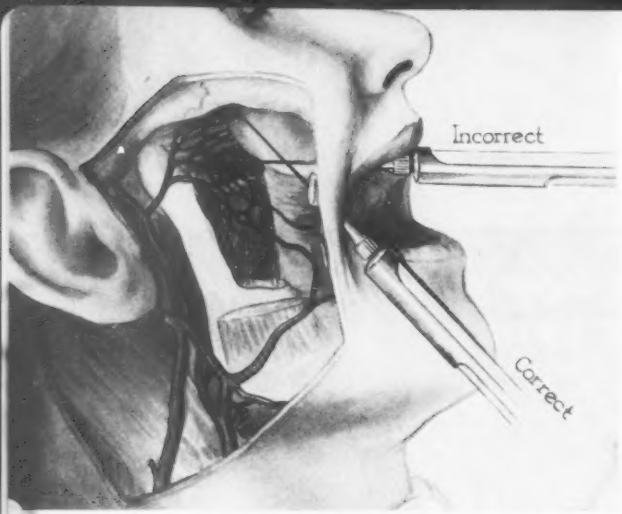

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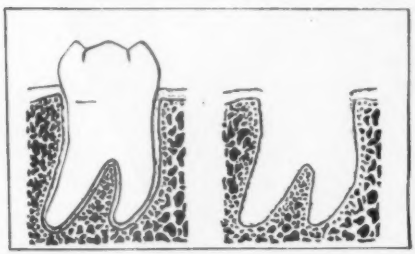

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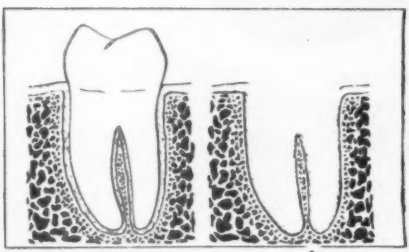

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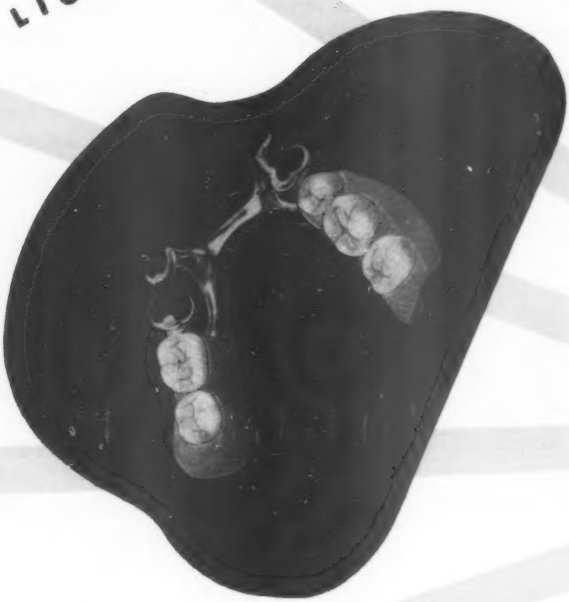

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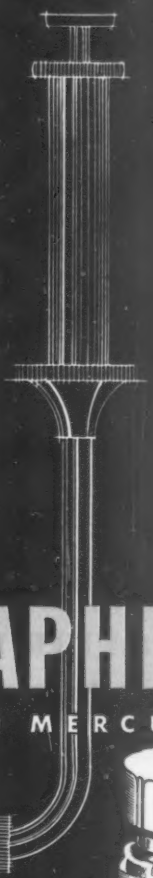

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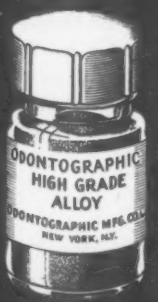

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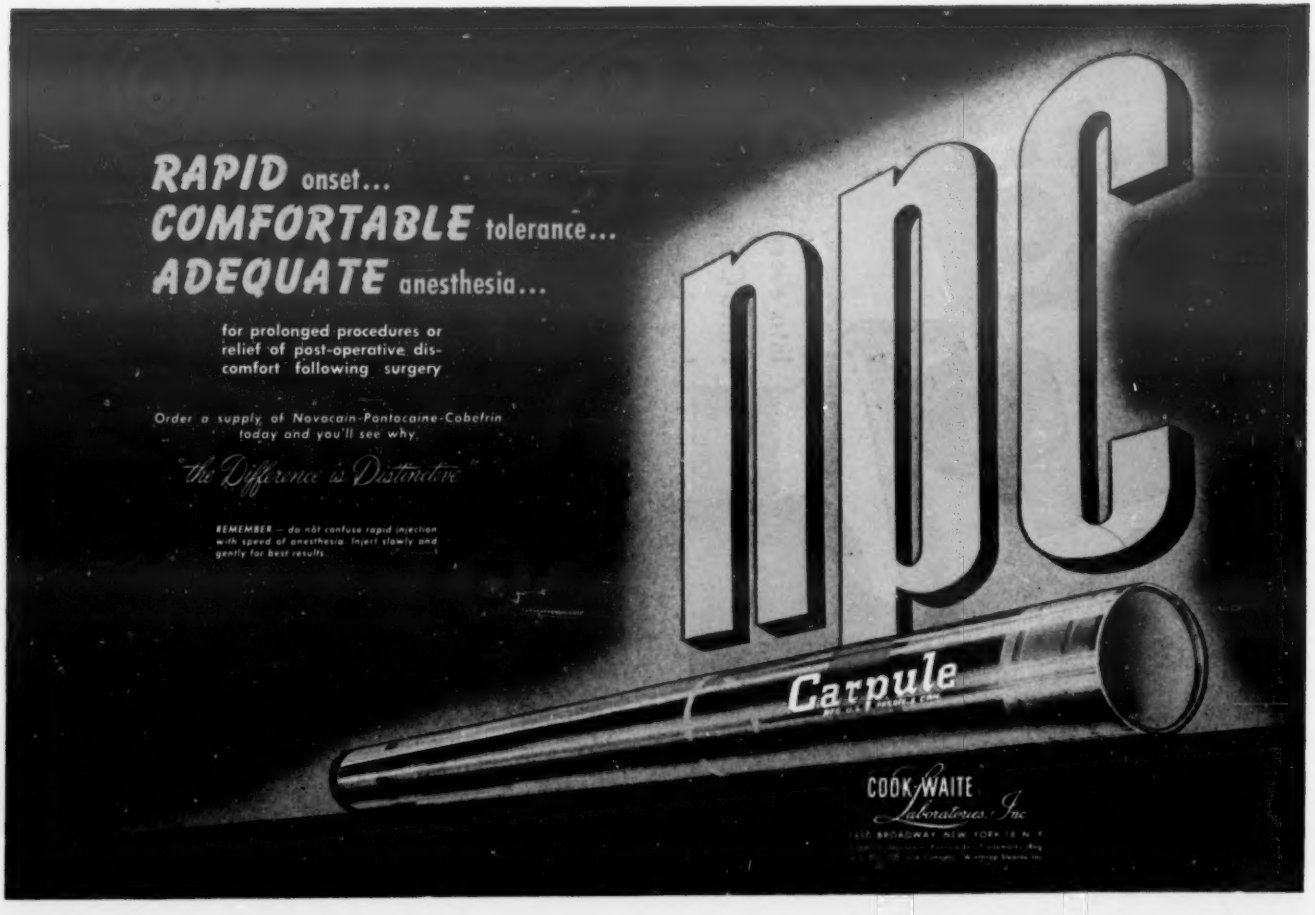
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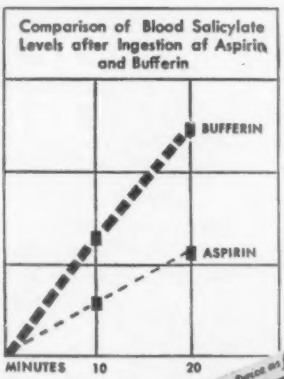

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THE Journal OF THE AMERICAN DENTAL ASSOCIATION

VOLUME 45 • NUMBER 3

Dental amalgam: the effect of mechanical condensation on some physical properties

Gunnar Ryge, D.D.S. (Copenhagen); George Dickson,† M.A.; D. L. Smith,‡ B.S., and I. C. Schoonover,§ Ph.D., Washington, D.C.*

Several different types of mechanical condensers have appeared on the market during recent years. Some are sold under claims that mechanical condensation of dental amalgam gives better restorations than does hand packing. Unfortunately, however, not enough numerical data have been published to make possible a comparison of the properties of hand condensed and mechanically condensed amalgams.

R. W. Phillips[1] compared the compressive strength of specimens amalgamated mechanically and packed either by heavy hand pressure or by a pneumatic condenser. He found a slight tendency for the pneumatic condenser to increase the one-hour compressive strength, while the 24-hour compressive strength was about the same for the two types of condensation. The same tendency can be seen in the data of another paper by the same author.[2] No significant relationship between the condensation method and the mercury content is shown in these papers.

Taylor and his co-workers[3] stated that "Laboratory data indicated no significant improvement in the crushing strength of amalgam as a result of mechanical rather than hand condensation." In these three reports, however, other variables such as alloy-mercury ratio, method of trituration and rate of applying the load were given more at-

*Guest worker at the National Bureau of Standards from Danmarks Tandlaegehojskole, Copenhagen, Denmark; now at Marquette University, School of Dentistry, Milwaukee.

†Physicist, National Bureau of Standards.

‡Research associate, American Dental Association, National Bureau of Standards.

§Chief, Dental Research Laboratory, National Bureau of Standards.

1. Phillips, R. W. Physical properties of amalgam as influenced by the mechanical amalgamator and pneumatic condenser. J.A.D.A. 31:1308 (Oct.) 1944.

2. Phillips, R. W., and Boyd, D. A. Importance of the mercury-alloy ratio to the amalgam filling. J.A.D.A. 34:451 (April 1) 1947.

3. Taylor, N. O., and others. Effects of variable factors on crushing strengths of dental amalgams. J.D. Res. 28:228 (June) 1949.

Table 1

Composition	Alloy A	Alloy B
Silver	69.0	70.3
Tin	26.6	25.7
Copper	3.9	2.3
Zinc*	0.5	1.7

*By difference

tention than was the method of condensation.

In this study a comparison is made of the effects of three different mechanical condensers and three different technics of hand packing on compressive strength, dimensional change on setting, mercury content and microstructure.

MATERIALS AND TECHNICS EMPLOYED

Two alloys on the American Dental Association List of Certified Dental Materials were used. Their compositions are given in Table 1. Photomicrographs of the particles of each alloy are shown in Figure 1.

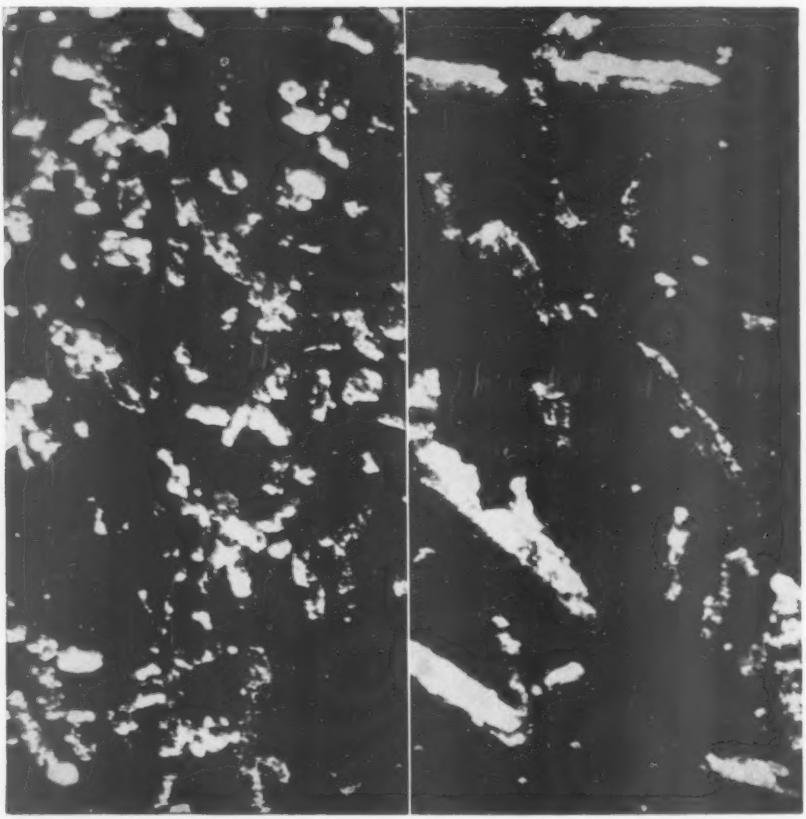

Fig. 1 • Photomicrographs of particles of alloys, magnification approximately 75 diameters. Left: Alloy A. Right: Alloy B

In accordance with the manufacturers' instructions both alloy A and alloy B were used at an alloy-mercury ratio of 5:8.

All specimens were made from 2.00 Gm. of alloy and 3.20 Gm. of mercury. The alloy and mercury were weighed on a torsion balance to an accuracy of 0.005 Gm.

The amalgam for all specimens was triturated in the Wig-L-Bug mechanical amalgamator for 10 seconds. This 10-second trituration period gave a mix similar to that produced by following the manufacturers' directions for mixing by hand.

After trituration the amalgam was taken out of the capsule, placed on a squeeze cloth, rolled with light pressure into a rope about 3 to 4 mm. in diameter and 30 mm. in length without any attempt to express mercury. Fifty to 60 seconds elapsed from the time of starting the amalgamation until the rope was formed. The amalgam was never touched by hand; the operator wore a rubber glove or finger cots. The rope was cut into six approximately equal segments. Just prior to being packed, each segment was placed in the Chott pliers (Fig. 2 A) and the mercury was expressed by applying a force of 12 pounds to the alloy cell plunger, which had a diameter of 4.0 mm. This method of removing excess mercury was used in all technics except Technic 3 hereinafter described.

All specimens were formed by condensing the amalgam in a steel mold (Fig. 3 B). Specimens used in the determination of the dimensional change were 10.0 mm. long and 5.04 mm. in diameter with one end cone-shaped (Fig. 3 A). Specimens used in the determination of the compressive strength were cylinders 8.5 mm. long and 5.04 mm. in diameter (Fig. 3 C). Specimens of this size were used in order that setting expansion and compressive strength values could be obtained on the same specimen. Dimensional change specimens were used for compressive strength determinations after removal of the conical ends of the specimens.

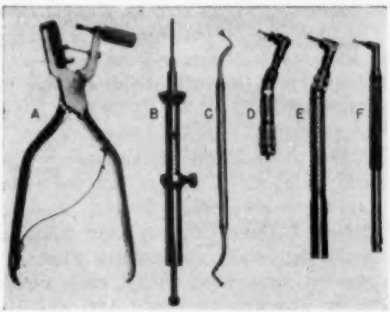

Fig. 2 • Instruments used. A: Chott pliers. B: 2 mm. plugger. C: Sweeney plugger. D: American condenser. E: Swedish condenser. F: Pneumatic condenser

PACKING TECHNICS

Technic 1 • (Hand condensation) After excess mercury was expressed with the pliers, each increment was packed in the steel mold with 12 thrusts on a 2 mm. plugger (Fig. 2 B) under a force of 6 pounds. Five increments were used to fill the mold. Excess "mercury," mercury-rich amalgam, was removed from the

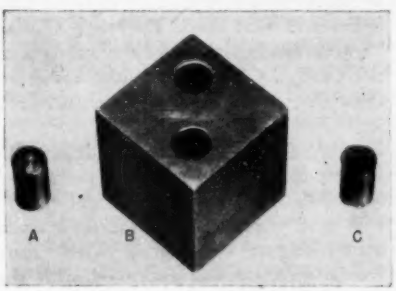

Fig. 3 • Mold and specimens. A: Dimensional change specimen. B: Mold. C: Compressive strength specimen

mold after each increment was packed. The time elapsed between the beginning of the amalgamation and the ejection of the specimen from the mold was five to six minutes.

Technic 2 • (Hand condensation) The same plugger (2 mm.) and force (6 pounds) were used in Technic 2 as in Technic 1, but 40 thrusts were made in condensing each increment. Five increments were used to fill each mold. Excess mercury-rich amalgam was removed from the mold after each increment was packed. The time elapsed between the beginning of the amalgamation and the ejection of the specimen from the mold was six to eight minutes.

Technic 3 • (Hand condensation) In this technic no mercury was expressed prior to packing. A large round Sweeney type plugger, 4.4 mm. in diameter (Fig. 2 C), was used for packing. Each segment was condensed by burnishing movements of the plugger with a force of 10 to 12 pounds. The mercury-rich amalgam so formed was then removed with the plugger. After the six segments of the rope were used, the mold was not filled. The thin material removed during the packing was then placed in a squeeze cloth, and the mercury was expressed by heavy finger pressure in order to form two or three more increments required to fill the mold. A total of eight or nine increments was used. The time elapsed between the beginning of the amalgamation and the ejection of the specimen from the mold was six to seven minutes.

Technic 4 • (Mechanical condensation) In this technic a mechanically actuated condenser of American make (Fig. 2 D) with a 2 mm. plugger was used on a dental engine running at 5,800 rpm. Excess mercury was expressed with the Chott pliers, and two of the six segments were used as the initial increment in order to get enough material to condense properly. Forty thrusts of the plugger, held under a force of about 4 to 6 pounds, were used in packing each increment. As long as pressure was put on the end of the plugger, it vibrated, giving short hard blows to the amalgam and forming a layer of extremely thin mercury-rich amalgam on top. This layer was removed before the next increment was placed. The thin material left over after the six original segments were used was rolled into a rope in a squeeze cloth and divided into three parts; the excess mercury was expressed in the pliers. A total of nine increments was used. The time elapsed between the beginning of the amalgamation and the ejection of the specimens from the mold was eight to nine minutes.

Technic 5 • (Mechanical condensation) Technic 5 was the same as 4 except that a mechanically actuated condenser of Swedish origin was used (Fig. 2 E). A force of 4 to 6 pounds was used on a 2 mm. plugger. This condenser has a cylindrical plugger which vibrates and gives lighter blows than the plugger used in Technic 4. The plugger of this condenser vibrates when touched on the end or on the sides. It was used with vertical thrusts combined with rotary movements of the plugger in the mold. A total of nine increments was used to fill the mold. The time elapsed between the beginning of the amalgamation and the ejection of the specimen from the mold was eight to nine minutes.

Technic 6 • (Mechanical condensation) Technic 6 was the same as 4 and 5 except that a pneumatic condenser (Fig. 2 F) was used with the handpiece set on notch 7 and with the air valve open halfway. The mold was filled with six or seven increments; the seventh increment was formed from the material removed during the condensation of the original six segments by the method outlined in Technics 4 and 5.

Table 2 • Properties of amalgam* condensed by different operators using hand and mechanical technics

Property	Unit	Operator no.	Hand technics			Mechanical technics		
			No. 1	No. 2	No. 3	No. 4	No. 5	No. 6
4 hour-compressive strength†	Pounds per square inch	1	27,000	33,0 0	32,000	40,000	44,000	31,000
		2	27,000	32,000	33,000	40,000	40,000	31,000
		3	33,000	36,000	30,000	46,000	45,000	25,000
24 hour-compressive strength†	Pounds per square inch	1	38,000	40,000	42,000	48,000	50,000	46,000
		2	34,000	41,000	39,000	49,000	48,000	41,000
		3	38,000	39,000	41,000	49,000	46,000	45,000
Dimensional change‡	Microns per centi-meter	1	+12	+1	+ 6	+1	− 5	+3
		2	+ 6	+3	+ 8	0	−11	+7
		3	+ 9	+5	+14	−4	−11	+3
Mercury content	Per cent	1	51.5	49	49.5	47	49.5	50
		2	48.5	50	48.0	47	50	50
		3	49	47.5	52.5	47.5	46.5	53

*Alloy A

†Averages of not fewer than three determinations. Variations of individual determinations from the average were approximately ± 1000 lb. per sq. in.

‡Variations of individual determinations from the average were approximately ± 2 μ. per cm.

RESULTS

Compressive Strength • Compressive strength determinations were made on specimens ½, 1, 2, 3, 4, 6, 8 and 24 hours and 1 week old; age was computed from the beginning of the amalgamation.

Immediately after removal from the mold all specimens were stored at mouth temperature (37°C.) until a few minutes before testing, which was conducted at room temperature (21°C.). Both ends of the specimens were polished by using an Aloxite Waterproof Paper No. 400 A on a plane glass plate. The specimens were held in a guard ring so that the ends of each specimen were plane and parallel and normal to the axis of the specimen. The dimensional change specimens were used as 24-hour-old compressive strength specimens after the conical tops had been machined off.

The load was applied at a rate of 650 pounds per minute (approximately 21,000 pounds per sq. in. per minute).

The four-hour and 24-hour values for compressive strength of specimens made from Alloy A by three operators using all six technics are shown in Table 2.

The compressive strength of specimens condensed by two of the three mechanical condensers (Technics 4 and 5) is greater than that of specimens packed by hand. This is true for specimens of all ages and for specimens made from both alloys. The difference between hand Technic 1 and mechanical Technics 4 and 5 is particularly noticeable (Fig. 4) during the first three hours. During that time the rate of increase of compressive strength is appreciably greater for specimens made by the mechanical technics. No appreciable difference in rate of increase or final compressive strength is apparent between these two mechanical technics.

The four-hour compressive strength values of Technic 6 (pneumatic mechanical condensation) are on the same level as those of the hand Technics 1, 2 and 3, while the 24-hour values fall between the values obtained by hand packing and by the other mechanical condensation technics.

The 24-hour compressive strength values obtained by Technic 1 are slightly lower than those obtained by the other two hand technics.

There is no significant difference in the magnitude of the values obtained by the three different operators.

The variations in compressive strength with age of specimens made by Operator 1 from the two alloys by three different methods of condensation (Technic 1, hand condensation; Technics 4 and 5, mechanical condensation) are shown in Table 3 and Figure 4.

The compressive strengths of the two different alloys increased at different rates. This is true for both hand condensed and mechanically condensed specimens. Within six to eight hours the compressive strength of specimens made from Alloy A was approximately the same as that of specimens 1 week old. About 24 hours was required for the specimens made from Alloy B to attain a compressive strength approximately equal to the strength of specimens 1 week old. At the end of one week specimens made from the two alloys did not differ appreciably in compressive strength.

Dimensional Change • The dimensional change on setting was determined by means of the interferometer[4] at mouth temperature (37°C.) on specimens placed in position as soon as they were ejected from the mold. The fiducial reading was taken 15 minutes after the beginning of amalgamation.

The dimensional change values after 24 hours are included in Table 2. The trends of the dimensional change values indicate that, compared with hand condensation, the use of two of the mechanical condensers (Technics 4 and 5) causes less expansion or a contraction. The clinical significance of variations of

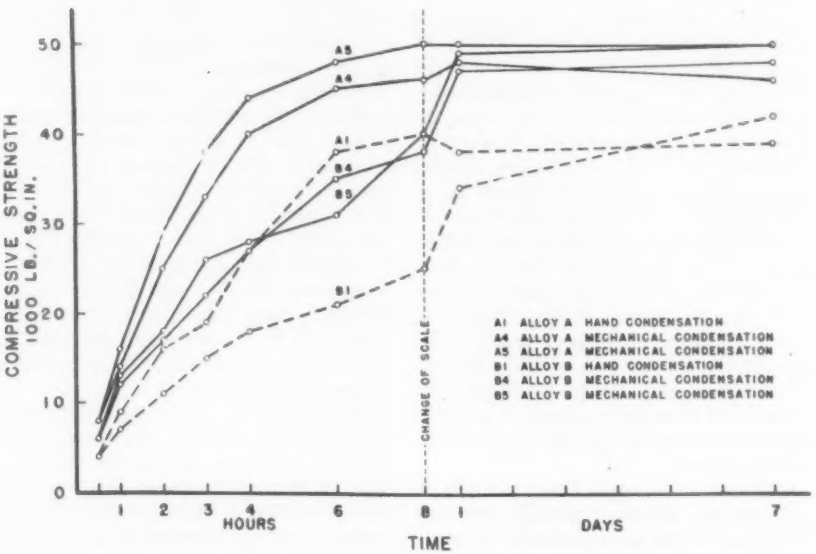

Fig. 4 • Compressive strength of amalgam versus time

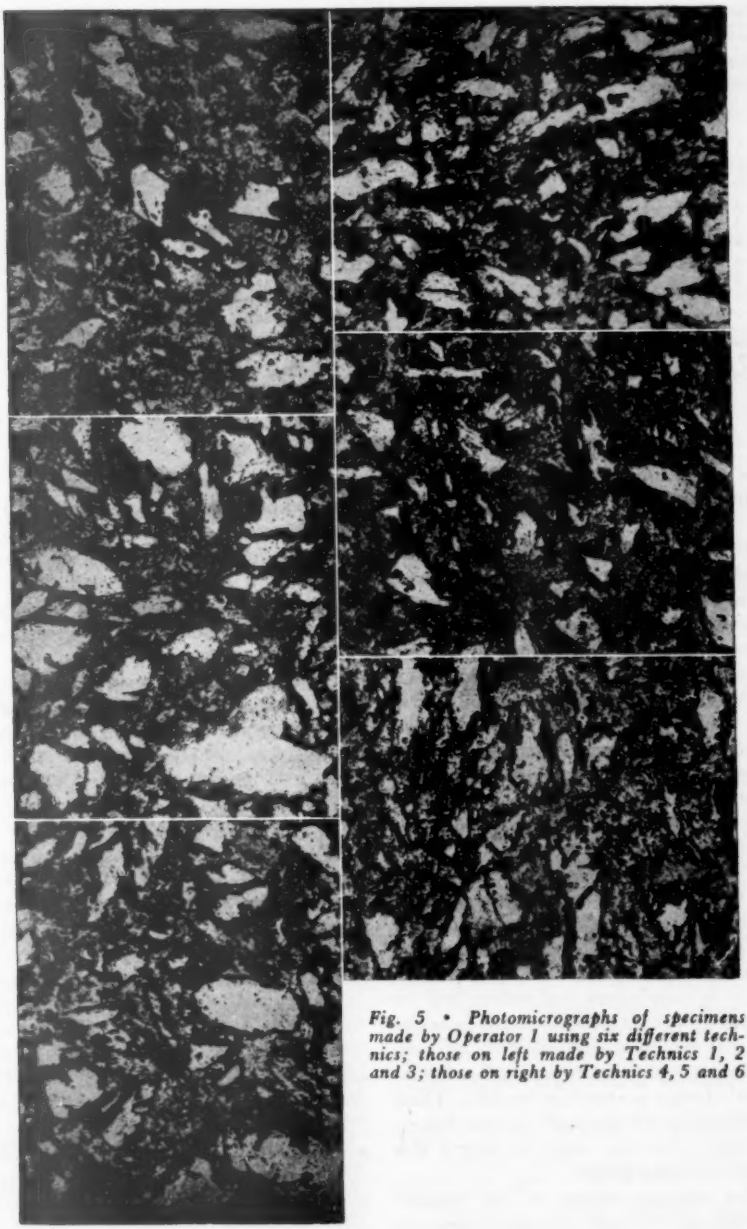

Fig. 5 • Photomicrographs of specimens made by Operator 1 using six different technics; those on left made by Technics 1, 2 and 3; those on right by Technics 4, 5 and 6

Table 3 • Effect of condensing technic and age on compressive strength of amalgams*

Age of specimen†	Hand technic 1		Mechanical technic 4		Mechanical technic 5	
	Alloy A	Alloy B	Alloy A	Alloy B	Alloy A	Alloy B
	lb. per sq. in.	lb. per sq. in.	lb. per sq. in.	lb. per sq. in.	lb. per sq. in.	lb. per sq. in.
½ hour	4,000	4,000	8,000	6,000	8,000	6,000
1 hour	9,000	7,000	14,000	12,000	16,000	13,000
2 hours	16,000	11,000	25,000	17,000	29,000	18,000
3 hours	19,000	15,000	33,000	22,000	38,000	26,000
4 hours	27,000	18,000	40,000	27,000	44,000	28,000
6 hours	38,000	21,000	45,000	35,000	48,000	31,000
8 hours	40,000	25,000	46,000	38,000	50,000	40,000
24 hours	38,000	34,000	48,000	47,000	50,000	49,000
1 week	39,000	42,000	46,000	48,000	50,000	50,000

*All values are averages of not fewer than three determinations. The variations of individual determinations from the average were in most instances less than ± 1000 lb. per sq. in.

†Specimens were aged at 37° C. (98.6° F.) and tested at 21° C. (70° F.).

this magnitude, however, has not been determined.

Microstructure and Mercury Content • Eighteen of the specimens used in measuring both the 24 hour dimensional change and the compressive strength were chosen for examination of microstructure and determination of mercury content. These specimens represent all six technics used by the three operators. Microstructure was examined on the largest fragment of each specimen. The fragments were embedded in a self-curing resin,[5] polished and etched; then photomicrographs were made.

Photomicrographs of specimens made by Operator 1, using the six different technics on alloy A, are shown in Figure 5. The study of the microstructure of these specimens and of 12 others did not result in conclusions concerning any relationship between the appearance of the internal structure and methods of condensation, compressive strength, dimensional change or mercury content. These photographs are included for the benefit of those who may wish to extend this phase of investigation.

The mercury content of the remaining portion of each specimen used for microstructure was determined by the method outlined by H. J. Caul and I. C. Schoonover.[6] The amount of sample available for the chemical analysis varied from 0.5 to 1.3 Gr. (one fourth to two thirds of the total weight of the specimens). The values obtained are shown in Table 3.

No relation can be seen between mercury content and method of condensation, compressive strength or dimensional change.

CONCLUSIONS

1. Two of the three methods of mechanical condensation (Technics 4 and 5) caused higher early and higher final compressive strength than did hand condensation.

2. Within 24 hours two of the methods

4. Souder, Wilmer, and Paffenberger, G. C. Physical properties of dental materials. N.B.S. Circular 433. United States Department of Commerce, National Bureau of Standards. Washington, D. C., Government Printing Office, 1942, p. 6-10.

5. Smith, Denton L. Room temperature mounting of metallurgical specimens. N.B.S. Tech. News Bull. 34:31 (March) 1950.

6. Caul, H. J., and Schoonover, I. C. An analysis of dental amalgams containing mercury, silver, gold, tin, copper and zinc. N.B.S. Research Paper, vol. 26 (June) 1941.

of mechanical condensation (Technics 4 and 5), as compared with hand condensation, caused less expansion or a shrinkage.

3. The mercury content of specimens made by different operators using the same technic varied in most instances. No relationship was seen between mercury content and compressive strength, dimensional change or microstructure.

The influence of systemic diseases on alveolar bone

S. S. Stahl, D.D.S., M.S.; J. M. Wisan,† D.D.S., M.S.P.H., and S. C. Miller,‡ D.D.S., Brooklyn, N. Y.*

This study was undertaken in order to investigate the influence of chronic systemic diseases on the integrity of the alveolar bone. It has been suggested that systemic disease may influence the rate and determine the type of alveolar bone resorption. This study will attempt to evaluate the relation of alveolar bone resorption to certain systemic diseases.

REVIEW OF LITERATURE

Many authors have noted the influence of systemic disease, as well as aging, on the alveolar bone. Schour and Massler,[1] discussing diabetes in adults, state, "The age factor . . . is as important as the disease entity, since both hasten and accentuate the breakdown of the periodontal tissues by a lowering of tissue vitality and resistance." Thomas[2] reports that, "Normally with advancing age, there is resorption of the alveolar crest." The increase in resorption of alveolar bone with aging is not restricted to bone alone, but, as pointed out by Henry and Weinmann,[3] cementum resorption also increases with advancing age. These age changes may be modified by disturbances of metabolism. Orban[4] states, "Systemic disease can change the character of an existing gingival or periodontal disturbance so that the clinical as well as pathologic picture might be altered and aggravated. In these cases we can speak of

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‡Consultant in periodontia, Brooklyn Veterans Administration Hospital; professor of periodontia and chairman of periodontia department, New York University College of Dentistry, New York.

1. Schour, Isaac, and Massler, Maury. Endocrines and dentistry. Chicago, American Dental Association, 1943. p. 23.

2. Thomas, B. O. A. Gerodontology: the study of changes in oral tissues associated with aging. J.A.D.A. 33:207 (Feb.) 1946.

3. Henry, J. L., and Weinmann, J. P. The pattern of resorption and repair of human cementum. J.A.D.A. 42:270 (March) 1951.

4. Orban, Balint. Symposium on systemic aspects of periodontal diseases. J. Periodont. 19:134 (Oct.) 1948.

the systemic diseases as a modifying factor." Miller[5] classifies the etiologic factors of periodontal disease as dysfunctional, irritational and systemic. Instances of modifying influence on the alveolar bone of diseases such as tuberculosis, diabetes and others, while not diagnostically significant, have been reported by Tanchester and Sorrin,[6] Sheppard,[7] Lovestedt and Austin[8] and others. Stahl,[9] in a study of the roentgenographic changes in diabetics, reported that an increase in the severity of the diabetic state showed an increase in the severity of alveolar crest resorption.

Disturbances in metabolism, as stated by Boyle,[10] ". . . may handicap tissues, including the periodontal tissues, in maintaining normal function. Under such conditions, periodontal disease may develop and run a rapid course although local causative factors may be minimal."

5. Miller, S. C. Textbook of periodontia, ed. 3. Philadelphia, Blakiston Co., 1950, p. 72.

6. Tanchester, David, and Sorrin, Sidney. Dental lesions in relation to pulmonary tuberculosis. J. D. Res. 16:69 (Feb.) 1937.

7. Sheppard, Irving. Alveolar resorption in diabetes mellitus. D. Cosmos 78:1075 (Oct.) 1936.

8. Lovestedt, S. A., and Austin, L. T. Periodontoclasia in diabetes mellitus. J.A.D.A. 30:273 (Feb.) 1943.

9. Stahl, S. S. Roentgenographic and bacteriologic aspects of periodontal changes in diabetics. J. Periodont. 19:130 (Oct.) 1948.

10. Boyle, P. E. Constitutional factors predisposing to periodontal disease. J.A.D.A. 37:325 (Sept.) 1948.

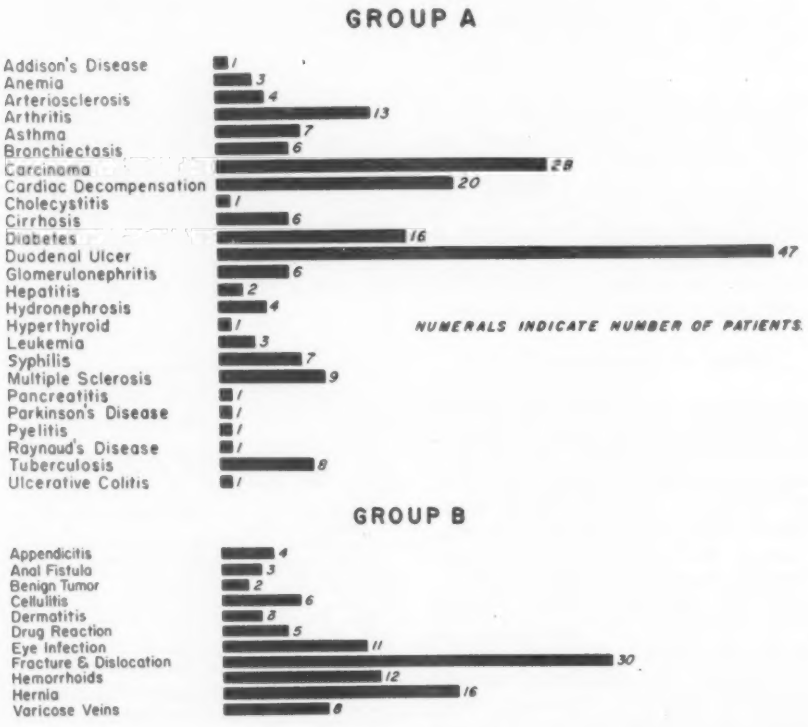

Fig. 1 • Disease distribution

Table • Age distribution of patients in Group A and Group B

Age groups (in years)	Number of patients	
	Group A	Group B
20–29	37	36
30–39	64	35
40–49	25	10
50–59	49	15
60–69	25	4
	200	100

MATERIAL

Roentgenograms of 300 male patients, ranging in age from 22 to 69 years, were taken at random at the Brooklyn Veterans Administration Hospital; the only qualification being that in the systemic disease group, the patients experienced

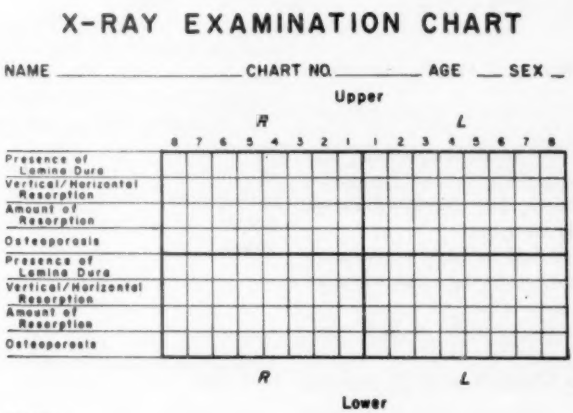

Fig. 2 • Chart devised to record information for this study

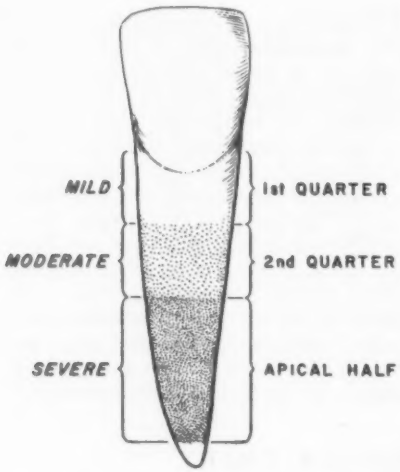

Fig. 3 • Classification of alveolar crest resorption

symptoms of the disease at least one year prior to the time the dental roentgenograms were taken. The average duration of disease was six years.

Each patient had to have a minimum of eight teeth in order to be included in the study.

The 300 male patients studied consisted of 200 patients suffering from systemic diseases, Group A, and 100 patients suffering from fractures and other local ailments for which hospitalization was necessary, Group B (Fig. 1). The duration of the ailments in Group B was usually less than one year.

The age distribution of patients in Groups A and B is shown in the table.

METHOD

A chart was devised which enabled the examiner to record: (1) the presence or absence of a lamina dura at the alveolar crest; (2) rapid or slow resorption at the alveolar crest (Miller's classification[11]); (3) the relation of each alveolar septum to the adjacent mesial root. This chart is shown in Figure 2.

Alveolar crest resorption within the coronal quarter of the root length was classified as mild, resorption within the second quarter of the root as moderate and resorption within the apical half of the root as severe (Fig. 3). A majority of crest-root relations determined the classification of the entire roentgenographic series as mild, moderate or severe.

11. Miller, S. C., and Peltzer, R. H. An original classification of alveolar types in periodontal disease. J.A.D.A. 26:565 (April) 1939.

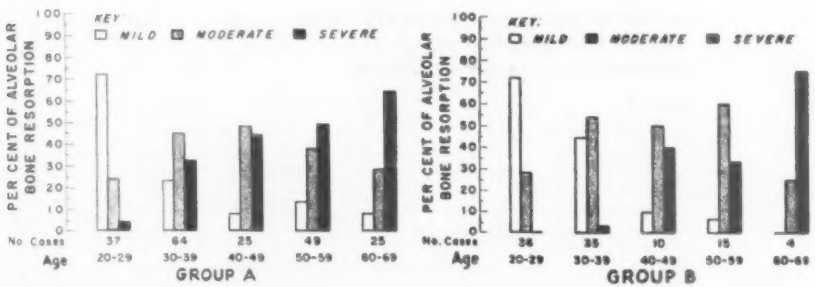

Fig. 4 • Amount of alveolar bone resorption in relationship to age of patients

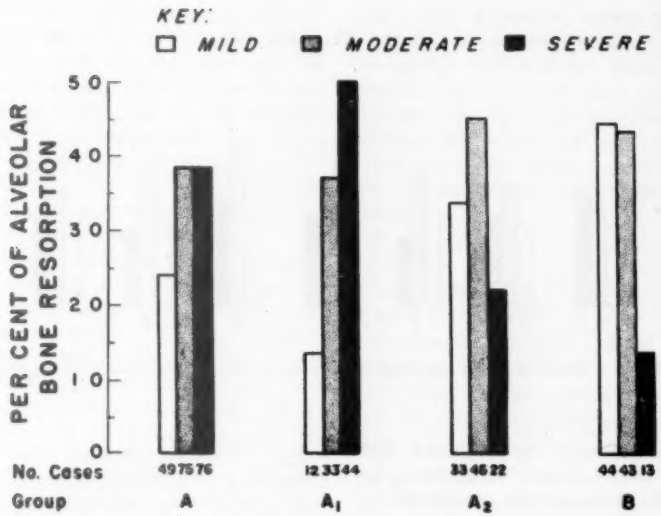

Fig. 5 • Relation of alveolar bone resorption to disease severity. Group A: 200 patients with systemic disease. Group A_1: 89 patients from Group A with the following diseases—carcinoma, cardiac decompensation, cirrhosis, diabetes, hepatitis, leukemia, syphilis, nephritides and tuberculosis. Group A_2: Remaining patients in Group A. Group B: 100 patients with fractures and other local ailments only

FINDINGS

1. It was noted that with increasing age, alveolar crest resorption was more severe in all cases (Fig. 4).

2. Certain disease entities, Group A_1, seemed to be associated with more severe alveolar crest resorption than other diseases (Fig. 5). Duration of the disease was not correlated with the severity of resorption (Fig. 6).

3. The tendency of increased alveolar resorption with aging appeared to be aggravated by the presence of the systemic diseases of Group A_1 (Fig. 7).

4. The lamina dura was present in more instances in Group B patients than in those of Group A.

5. Rapid and slow alveolar resorption occurred equally in both groups.

6. Severity of alveolar crest resorption around anterior teeth was compared with that of posterior teeth. In 87 per cent of the 300 subjects examined, the severity of resorption noted in the anterior region equalled the severity noted in the posterior region.

7. The most severely affected regions were the maxillary molar and the mandibular incisor regions.

8. The standard error of difference was calculated, and the differences were found to be significant.

DISCUSSION

Aging seems to influence alveolar crest resorption. This tendency seems to be aggravated by systemic disease. Diseases such as carcinoma, diabetes and the

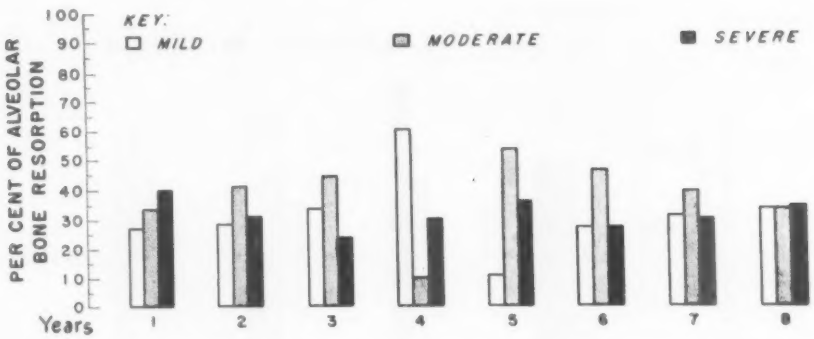

Fig. 6 • Relationship of duration of disease to amount of alveolar bone resorption

nephritides seem to be associated with the more severe changes. In searching for a common denominator responsible for the increased severity of alveolar resorption, it was noted that a disturbance in protein metabolism was common to all the disease entities listed in Group A_1. A disturbance of the protein metabolism might well interfere with osteogenic activity. Obviously, this may only be one phase of a complicated system of metabolic changes. As understanding of tissue building and tissue breakdown increases, a more definite answer to this problem should be forthcoming.

Undoubtedly, local factors are of extreme importance in causing alveolar resorption. As has been pointed out by

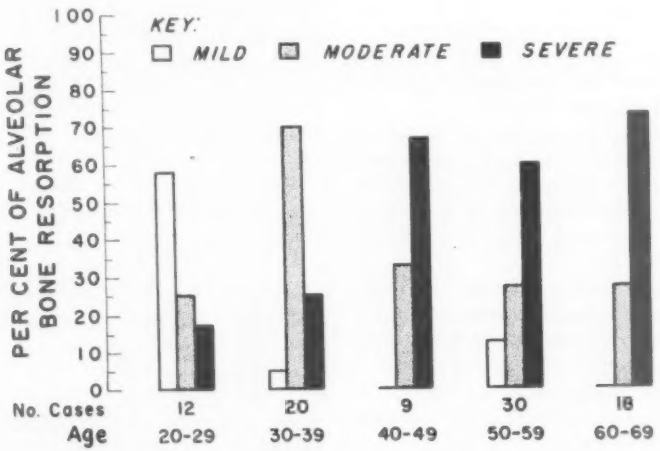

Fig. 7 • Relationship of age in Group A_1 patients to amount of alveolar bone resorption

Goldman[12] and Glickman and others,[13] the gingival condition does not necessarily determine the resorption of the alveolar bone, but other influences may play an important role in this process. This again tends to emphasize that periodontal disease is a syndrome complex rather than a disease entity, since the oral symptoms may often be modified by general systemic changes.

Our finding of equal resorption in the majority of the anterior and posterior regions seems to be in agreement with the findings of Seidler, Miller and Wolf,[14] and Miller and Seidler,[15] who found that in young individuals alveolar resorption was particularly severe in the incisor and first molar regions, and the clinical observations by Schour and Massler,[16] who noted that the gingival condition of the lower anterior teeth provided a fairly good index of the general gingival condition. Thus, the findings of the amount of alveolar resorption in a majority of regions in each roentgenographic series provide a fairly good indication of the general amount of alveolar resorption which might have been present even in regions that are now edentulous.

SUMMARY AND CONCLUSIONS

Roentgenographic series of 300 male patients, ranging in age from 22 to 69 years, were examined at the Brooklyn Veterans Administration Hospital. Of this group 200 suffered from various systemic diseases of at least one year's duration, and 100 patients suffered from fractures and other local ailments which would ordinarily not be expected to affect general cellular metabolism to any extent.

It was noted that:

1. Alveolar crest resorption seemed to increase with aging in all cases.

2. Diseases affecting general cellular metabolism seemed to be associated with more severe alveolar resorption.

3. In a majority of the patients in the series, the amount of alveolar resorption in the anterior teeth equalled the amount of resorption in the posterior teeth.

12. Goldman, Henry. Relationship of the gingival crevice and the alveolar crest. J. D. Res. 21:561 (Dec.) 1942.

13. Glickman, Irving; Morse, Anna, and Robinson, Leonard. The systemic influence upon bone in periodontoclasia. J.A.D.A. 31:1435 (Nov.) 1944.

14. Seidler, B. B.; Miller, S. C., and Wolf, William. Systemic aspects of precocious advanced alveolar bone destruction. J.A.D.A. 40:49 (Jan.) 1950.

15. Miller, S. C., and Seidler, B. B. Relative alveoclastic experience of the various teeth. J. D. Res. 21: 365 (Aug.) 1942.

16. Schour, Isaac, and Massler, Maury. Gingival disease in postwar Italy (1945): I. Prevalence of gingivitis in various age groups. J.A.D.A. 35:475 (Oct. 1) 1947.

Prevention of Disease • The prevention of disease today is one of the most important factors in the line of human endeavor. *C. H. Mayo, "Constitutional Diseases Secondary to Local Infections." Dental Review 27:281, 1913.*

Movements of the condyle from rest position to initial contact and full occlusion

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The temporomandibular joint has presented a problem for a great many years, and in an attempt to shed some light on the subject a roentgenographic study of this controversial region was undertaken. A perusal of the literature concerning the temporomandibular joint reveals conflicting ideas and statements relative to certain fundamental considerations, one of which is the position of the condyle in the glenoid fossa. Probably the principal reason for these conflicts is the limited methods for the study of this region.

REVIEW OF THE LITERATURE

According to the writings of John Hunter,[1] the determination of the anatomic relationship of the condyle to the glenoid fossa was stated as follows:

> In the lower jaw, as in all joints of the body, when the motion is caused to its greatest extent, in any direction, the muscles and ligaments are strained, and the person made uneasy. The state, therefore, into which every joint most naturally falls, especially when we are asleep, is nearly in the middle, between the extremes of motion; by which means all the muscles and ligaments are equally relaxed. Thence it is, that commonly and naturally, the teeth of the two jaws are not in contact; nor are the condyles of the lower jaw so far back in the temporal cavities as they can go.

Since this early beginning, many theories and hypotheses have been promulgated in an honest effort to clarify this problem. Riesner[2] stated:

> There is a general fallacious opinion, I believe, of what constitutes the normal of this articulation. Despite the fact that texts on anatomy have clear delineations of it, we still believe the myth that the head of the mandibular condyle lies in the deep recess of the mandibular fossa in close approximation with its roof. This opinion is wrong. It is essential to understand what a normal mandibular articulation is, before we can recognize the abnormal. The normal mandibular articulation has the following characteristics:
>
> 1. The temporal surface presents a smooth, even, shallow fossa and a full contoured articular eminence.
> 2. The condyle in sagittal plane is somewhat elliptical and is tilted forward slightly.
> 3. The articular relationship with the teeth occluded is between the upper part of the anterior surface of the condyle and the posterior surface of the articular eminence.
> 4. When the mouth is opened, the condyle occupies a position directly below the crest of the articular eminence.

Riesner, therefore, has given a definition of the normal relationship of the condyle with the articular eminence when

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The opinions and assertions contained herein are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Department or the Naval Service at large.

Lieutenant, junior grade (D.C.) U. S. Navy, now on active duty.

1. Hunter, John. The natural history of the human teeth. London, J. Johnson, 1771.

2. Riesner, S. E. Temporomandibular articulation. Int. J. Orthodont. & Oral Surg. 22:1 (Jan.) 1936.

the teeth are occluded. However, Robinson[3] defines the normal position thus,

> The condyles, in centric relation (to be distinguished from centric occlusion), are closest to the posterior surface of the articular tubercle. This, the thinnest part of the disc, is approximately at the junction of its anterior and middle thirds. Above, the condyle is separated from the temporal bone by the thickest part of the disc. This distance is approximately four times that of the bone separation at the anterior surface of the condyle.

Representative of those working in the field, it is only proper to give due consideration to the work of Goodfriend,[4] from whom many accept his hypothesis that, "With the teeth occluded, the condyle is not in articulation with the mandibular fossa. The articular relationship is between the anterior portion of the superior surface of the condyle and the inferior portion of the posterior surface of the articulating eminence." He continues further by saying that, "Standardization of the normal mandibular articulation was undertaken on the basis of normality defined as a state of health and function, which is evidenced, clinically, by normal movements of the joint in the articulation of speech and the mastication of food; by the absence of occlusal trauma and the associated reflex symptoms."

From the foregoing statement is derived a more intelligent approach to the problem by obviating any pathology that may have been present prior to examination and study of the temporomandibular joint which, conceivably, may have altered the region under consideration. It will also be noted, that in some of the definitions of the so-called "normal" position of the condyle in the glenoid fossa, the maxillary and mandibular teeth are occluded, while in other instances there exists a space between the two arches. Thompson[5] has pointed out that,

> The normal closing movement of the mandible from rest position to occlusion is a hinge movement with the fulcrum located in the lower half of the temporo-mandibular joint. The chin point and mandibular incisors move upward and forward. The mandibular molars move on a similar but smaller arc since they are nearer the fulcrum. In most instances, there is no translatory movement of the superior surface of the condyle. Occasionally, slight movement is noted, and in these cases the closure is translatory, rather than hinge. If slight, this may still be considered normal.

This immediately raises the question as to what should be considered the ideal starting point for determining the position of the condyle in the fossa: the teeth in occlusion or the mandible at rest position. In Pippin's[6] discussion of the treatment of temporomandibular lesions, he states,

> The normal position of the condyle in the fossa of an adult with complete dentition, teeth unmutilated on their occlusal surfaces and in perfect occlusion will be as follows: When a line is drawn from the center of the auditory meatus in the skull to the lower margin of the orbit, it will just touch the upper border of the condyle. This line serves as a base for computations for the degree of abnormal condylar relationships.

Here, again, the teeth are in occlusion, but there is also another factor which must be taken into consideration. With a horizontal line, it is a simple matter to determine a superior or inferior displacement of the condyle, provided the foregoing hypothesis is acceptable, but the determination of a displacement in an anteroposterior direction is impossible if the superior surface of the condyle remains in juxtaposition with the line drawn as indicated by Pippin. In the dental literature can be found reference to the theory that centric relation of the

3. Robinson, M. The temporomandibular joint; theory of reflex controlled nonlever action of the mandible. J.A.D.A. 33:1260 (Oct. 1) 1946.

4. Goodfriend, D. J. Symptomatology and treatment of abnormalities of the mandibular articulation. D. Cosmos 75:844 (Sept.) 1933.

5. Thompson, J. The rest position of the mandible and its significance to dental science. J.A.D.A. 33:151 (Feb.) 1946.

6. Pippin, B. N. Symposium on treatment of temporomandibular lesions caused by denture mutilation. Illinois D. J. 12:429 (Oct.) 1943.

teeth necessarily places the condyles in their most retruded positions in the fossae.[7] Commenting on this Schier[8] raises the following question, "Presuming an acceptable definition of centric relation as necessitating the most retruded position of the condyle within the fossa, then when is a retruded condyle regarded as abnormal?" He continues that, "Meriting the most serious investigation is to determine just what constitutes a mean for acceptance as a norm for the position of condyle head within the fossa."

Thus far it has been shown that there exists a great deal of confusion concerning the position of the condyle in the glenoid fossa. Many of these problems have undoubtedly developed because of the methods employed in studying the temporomandibular joint and consequently their misinterpretations.

Of the various methods available today, Gillis[9] undertook a study of the temporomandibular joint by employing the use of roentgen rays; he reasoned that by this method the problem could be approached more closely from a functional point of view. Enumerating the deficiencies of other methods of study, Gillis brought out the fact that there are three methods of studying the temporomandibular articulation. One method is the use of the dry specimen, but this is without two vital factors, the interarticular cartilage and the musculature. Another alternative is the use of the wet specimen (dissection), but this is without muscle action. A third method is by the use of dental casts mounted on an articulator, but this method reveals only the changed position of a point of the condyle head and tells nothing of its relation to the fossa. Each of these methods, owing to the omission of certain vital factors, compels the investigator to speculate considerably in reaching his conclusions and leaves much to be desired. It is evident that the study of the temporomandibular joint is a complex entity in itself, but to employ methods in which erroneous conclusions are drawn merely adds to the confusion.

The literature presented herein has demonstrated that a great amount of conjecture exists as to the normal position of the condyle in the glenoid fossa. It has been indicated thus far that almost any position of the condyle in its fossa could be interpreted as being normal, depending on which of the many hypotheses advocated is accepted as being correct. The only acceptable evidence is that which is based on scientific fact as opposed to empirical methods of investigation.

METHOD

The purpose of this study was to try to determine, roentgenographically, the relative position of the condyle in the glenoid fossa when the mandible moved from rest position to initial contact and then to full occlusion of the teeth. Only clinically healthy mouths, with a full complement of teeth and a normal pathway of closure of the mandible from rest position to full closure through an acceptable freeway space, were studied. The rest position, as used in this discussion, refers to the position of the mandible as described by Niswonger[10] which is, "That position of the mandible in which it is involuntarily suspended by the reciprocal coordination of the muscles of mastication and the depressor muscles with the upper and lower teeth separated, or the neutral position of the mandible." The point of initial contact is that position of the teeth when they first make contact after the mandible moves from

7. Furnas, I. L. Centric relation in full denture construction. J.A.D.A. & D. Cosmos 25:718 (May) 1938.

8. Schier, M. B. A. Facts and fallacies on temporomandibular articulation and jaw relationships as pertains to deafness. D. Items Interest 62:507 (June) 1940.

9. Gillis, R. R. Roentgen-ray study of the temporomandibular articulation. J.A.D.A. 22:1321 (Aug.) 1935.

10. Niswonger, M. E. Obtaining vertical relation in edentulous cases that existed prior to extraction. J.A.D.A. & D. Cosmos 25:1842 (Nov.) 1938.

rest position through an acceptable freeway space and has traveled through a normal pathway of closure that is upward and forward.[5]

Fifty subjects were selected who met the following requirements:

1. No history of temporomandibular disturbances, past or present, which included the usual clicking noises associated with the region and reflex pain symptoms.

2. A full complement of teeth with excellent functional occlusion (third molars absent or present; if present not interfering with normal functional excursions of the mandible).

3. Normal pathway of closure of the mandible, passing through an acceptable freeway space from rest position of the mandible to full occlusion of the teeth.

4. No evidence of periodontal disturbances or history of treatment for same.

5. No history of or indication for orthodontic treatment.

Roentgenograms of each patient meeting these requirements were then taken using the Lindblom apparatus. The method as described by Lindblom[11] is a procedure of obtaining roentgenograms of the temporomandibular joint with the head of the patient maintained in an upright position during exposure of the film. After the patient was properly seated in the dental chair, a gauze bandage was placed about the head in such a manner so as to prevent movement of the head between the several exposures of film on the same side of the head and, also, during the transfer of the apparatus for taking roentgenograms of the opposite side.

Three positions of each condyle were obtained, one while the mandible was at rest position, another when the teeth were at initial contact and the third when the teeth were in full occlusion. Previous to making an exposure of the film, each of the various positions of the mandible was checked clinically, as often as necessary, in order to insure correct registration. With the adjustment of the Lindblom apparatus, while the patient was seated in the chair, it was found that a few patients were slightly apprehensive and the attempt to obtain a correct rest position of the mandible was difficult. Phonetic exercises were used with the pronunciation of such letters as "M," "N" and "C" to bring the mandible as close as possible to the desired position. This procedure had to be altered because a few patients were inclined to overpronounce these letters. The method as outlined by Thompson[5] was then used.

The simplest way to determine the rest position is to place the fingers over the temporal or masseter muscles and swallow. The muscles will be felt to contract and the teeth will come into occlusion. As the muscles relax, the mandible will move back to rest position. The mandibular teeth have traveled through the free-way space to occlude with the maxillary teeth and have then returned to rest position.

Tracings were made from the roentgenograms, superimposing in such a manner so as to demonstrate the movements, if any, of the condyle in relation to the glenoid fossa. Anatomic landmarks appearing in the roentgenograms, other than the temporomandibular joint region, were used to insure greater accuracy in the process of tracing. To check the roentgenographic method of interpretation, 12 cases were taken at random from the total group studied and additional roentgenograms were made at subsequent sittings. The results were compared with the original roentgenograms.

A few discrepancies, which prevented the use of statistical methods in analyzing the data, were the varying shapes of the condyles and fossae and the varying distances of the film from the temporomandibular joint. As the cassette was adjusted to the temporomandibular joint, the soft tissues of the face and under-

11. Lindblom, G. Technic for roentgen-photographic registration of the different condyle positions in the temporomandibular joint. D. Cosmos 78:1227 (Dec.) 1936.

lying bony structures of the lower border of the mandible occasionally interfered with the positioning of the film in close approximation to the temporomandibular joint.

The variations as outlined did not interfere with the analysis of the data as interpreted in this study, because only the three roentgenograms representing the same temporomandibular joint were compared with each other. Any change in one roentgenogram showed the identical change in the other two roentgenograms subsequently exposed in the same position. The law of physics, which explains these variations, states that light rays (including roentgen rays) diverge as they travel away from their source. Thus, the film will record a larger image of the temporomandibular joint the further it is away from it.

Shapiro and Truex[12] came to the conclusion, after comparing roentgenograms taken of the joint areas with subsequent dissections of the temporomandibular joints, that the lack of evidence as to the greater three dimensional region of the joint places definite limitations upon its value for diagnostic purposes. Schier[8] has substantiated these conclusions and states that,

> At this time, and within the confines of my own knowledge of other works, it is my conviction that there is no technique for radiographing the temporo-mandibular articulation that gives the juxtaposition of condyle to fossa. It is one thing to take a beautiful picture of the joint, but it is quite another to obtain a true radiograph of the joint.

The method of tracing roentgenograms, which were taken at the same sitting with the head in the same position as outlined earlier, is accurate for determining the relative movement, if any, of the condyle, but was not thought sufficiently accurate to make linear measurements. In the 50 cases studied, it was evident that they could be divided into any one of three categories based on the movement of the condyle in relation to the fossa. The first category included those in which the condyle showed a rotatory motion only from rest position to initial contact and full occlusion. The second grouping included all cases in which there was a translatory movement from rest position to initial contact while there was no translatory movement from initial contact to full occlusion. The third category included all cases which showed a translatory movement from initial contact to full occlusion. In this last group, the type of movement exhibited from rest position to initial contact was either a rotatory or translatory movement.

INTERPRETATION

The number of cases with a rotatory motion totaled 25, or 50 per cent, of all cases studied while the number of cases with a translatory movement were 20, or 40 per cent, of the total and 5 cases, or 10 per cent, showed a displacement. For purposes of this discussion the word displacement is used to mean the translatory movement of the condyle from the point of initial contact to full occlusion. It will be noted by referring to Figures 1 and 2 that in 45 of the cases studied there was no apparent movement of the condyle from the point of inital contact to full occlusion and that each movement of the condyle on one side corresponded to a similar movement on the opposite side of the same patient. The 5 cases exhibiting a displacement, however, did not follow a definite pattern: in other words, the movement of the right condyle did not correspond with the movements of the left condyle. Because of the asymmetry in movement of these cases a recheck was deemed necessary and of the 5 cases falling into this category only 3 were available for re-examination. It was found that in the original examination of

12. Shapiro, H. H., and Truex, R. C. Temporomandibular joint and the auditory function. J.A.D.A. 30:1147 (Aug.) 1943.

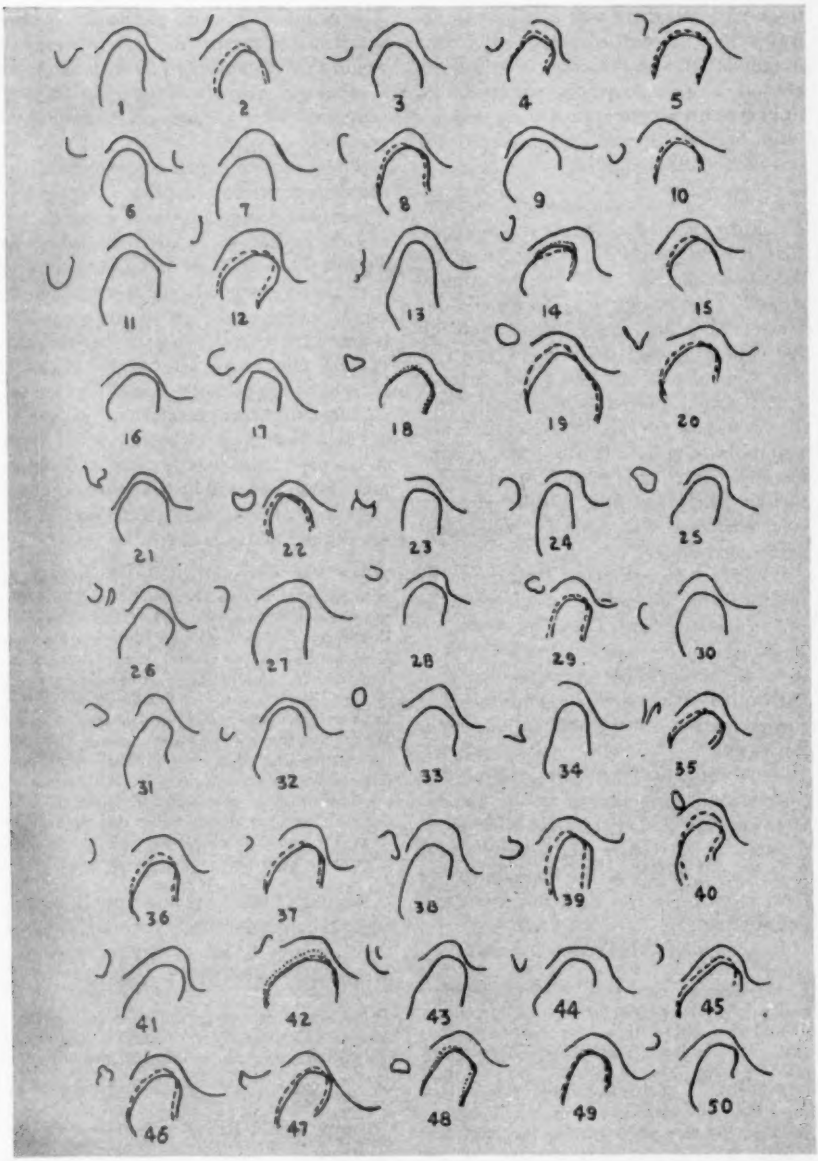

Fig. 1 • Composite of tracings of roentgenograms of the right temporomandibular joint made with the mandible at rest position, initial contact and full occlusion. Rest position (————); initial contact (– – – – –); full occlusion (. . . . . .)

these patients, there was a failure to detect a slight lateral displacement of the mandible from initial contact to full occlusion. This displacement was attributed to cuspal interference caused by unequal wear or restorations which altered the position of the mandible.

Of the 12 cases selected arbitrarily to check the method of study, it was found that 1 case which did not show a displacement of the condyle in the original series of roentgenograms, did show a displacement in the second series from initial contact to full occlusion. Upon further clinical examination, it was learned that a newly placed gold inlay located in an upper lateral incisor caused the mandible to shift laterally when closing from initial contact to full closure. Judicious grinding of this slight interference soon corrected the abnormal movement of the mandible.

The types of movement (translatory or rotatory) of the right and left condyles in the same patient, excluding the cases in which there was a lateral displacement of the mandible, corresponded with each other. It must be remembered that roentgenograms have their limitations in portraying a three dimensional object. It is a difficult matter to portray the proximity of the condyle to the glenoid fossa on film and to have it interpreted accurately. As is shown in Figures 1 and 2, the relationship of the condyle to the fossa is variable and does not show any definite pattern.

Ennis[13] makes the statement that,

> From what we now know as fact, we must realize that to define the normal temporomandibular articulation from the roentgenogram is beyond our limitations. The question may be asked, what is normal? And when it is defined, we can immediately show many cases that are not covered by the definition, yet must be classed as normal for that individual. . . . To say that the head of the condyle should be in a certain relationship to the eminentia articularis, or so many millimeters this way or that, to be normal in the roentgenograms is a misstatement of fact. . . .

There not only exists difficulty in the correct interpretation of roentgenograms, but it must also be kept in mind that no two individuals are alike; in fact, different parts of the same individual vary.

The Lindblom method, even with its disadvantages, has its place in dentistry; it permits roentgenographic examination of the condyle while the mandible is in the rest position. Even though the condyle may show a normal or abnormal movement, the rest position of the mandible is common to both. It is in this position that the muscles are relaxed and the maxillary and mandibular teeth are not in contact; thus, the musculature is free to act whether there is an abnormal path of closure of the mandible or a displacement of the mandible as the mandibular teeth articulate with the maxillary teeth. According to Kallenbach,[14]

> Many of the same elements are present in both the normal and abnormal cases. In order to make a satisfactory differential diagnosis, therefore, it is necessary to determine which elements have taken on an abnormal function. This can be done by using as a starting point of the diagnosis some element which remains unaltered in both normal and abnormal cases. When the mandible is in this rest position the temporo-mandibular joints are simultaneously in rest or neutral positions and, therefore, no joint trauma exists. In this zone of muscularly coordinated rest nothing happens, but it is the zone from which all movements, normal or abnormal alike, originate.

Realizing that any movement of the mandible directly affects the movement of the condyle, being of the same bone, Mershon[15] stated that,

> There is only one correct bite for each person. All the measurements, statistics and rules which have been assembled with the object of

13. Ennis, L. M. Study and development of the muscles of mastication, the temporomandibular articulation, and the styloid process. Am. J. Orthodont. & Oral Surg. 31:495 (Oct.) 1945.

14. Kallenbach, T. E. The abnormal temporomandibular joint. Illinois D. J. 11:93 (March) 1942.

15. Mershon, J. V. Bite-opening dangers. J.A.D.A. 26:1972 (Dec.) 1939.

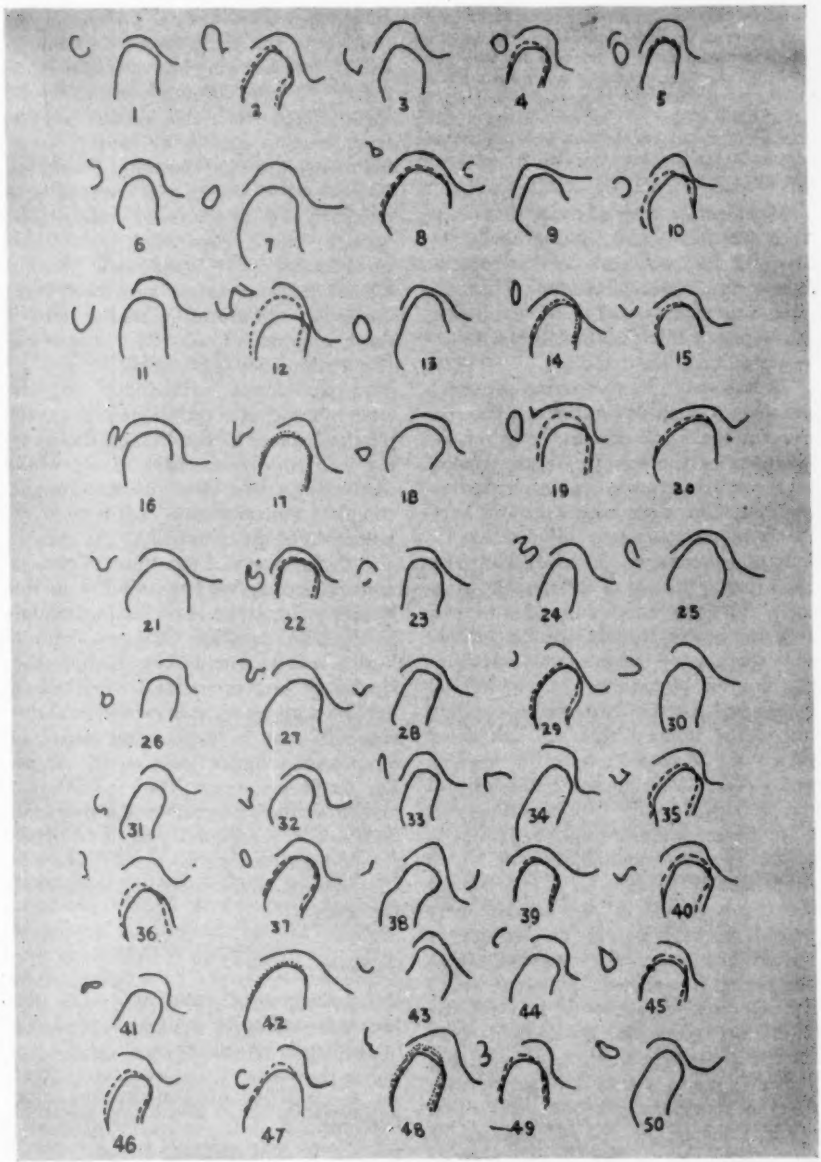

Fig. 2 • Composite of tracings of roentgenograms of the left temporomandibular joint made with the mandible at rest position, initial contact and full occlusion. Tracings were made to face in same position as those of right side

standardizing the length of the bite are dangerous because, in every individual, the muscles of mastication bear a relation to the other parts of the head which is not duplicated in any other person. For this reason, no amount of analysis of the bite or correlation of data can give us a hard and fast rule for all patients. Statistics cannot be used to determine the ideal bite for all individuals.

If this statement is accepted as true, then the relationship of the condyle to the glenoid fossa cannot be interpreted by means of statistical analysis. The interpretation of the word "bite" as used by Mershon in this instance, refers to the rest position of the mandible.

In this study, by comparing the roentgenograms of three positions of the condyle in the same patient, only relative positions of the condyle to the glenoid fossa were interpreted for each particular case. The cases which showed a rotatory movement might indicate that th axis of rotation was located in or near the superior portion of the condyle. Similarly, the cases which showed a translatory movement would seem to indicate that the axis of rotation was located in the inferior portion of the condyle, or even lower. Lord,[16] Wheeler[17] and others are of the opinion that the axis about which the mandible turns in opening and closing is through the midpoint of the ramus, closely approximating the mandibular foramen. This is one problem of the temporomandibular joint which needs further investigation. The type of movement shown by the condyle may possibly be explained by the location of the axis of rotation which may vary from one person to another. The point which is being stressed is that the rotatory and translatory movements should not be considered as abnormal.

From Figures 1 and 2, it can be seen that no statement can be made which would indicate the relative position of the condyle to the articular eminence by roentgenographic interpretation.

The importance of this study of attempting to discover roentgenographically the relative normal position of the condyle in the glenoid fossa is exemplified in the following statement by Berdmore,[18] "Where a tooth projects beyond the common level, and hinders the rest from meeting equally, or receives on itself alone all the pressure that should fall divided on a whole set, then filing is necessary at any age to remove the greater evil." Proceeding with this thought, Schuyler[19] states that, "Painful reflex syndromes may, however, in some instances be produced by malfunction of the temporomandibular joint due to occlusal anomalies of the teeth."

In periodontia, orthodontia and the various branches of prosthodontia, a mandibular balance or equilibrium should be the watchword; and back of the whole picture must be a clear visualization and complete understanding of a normal relationship of the mandible to the maxilla and their associated structures. Consider more seriously the responsibility in detecting and correcting occlusal anomalies as a general practice. Oral comfort and health will be greatly benefited by this service. A lack of occlusal coordination may be a prime cause of periodontal disease and may be a potential source of temporomandibular joint injury or reflex nerve irritations. Their elimination and prevention depend on the diagnosis and ability to reestablish a normal relationship between the jaws and functional coordination of the occluding surfaces of the teeth.

CONCLUSIONS

Roentgenographic examination of the temporomandibular joint as carried out in this study reveals that:

16. Lord, F. P. Movements of the jaw and how they are effected. Int. J. Orthodont. & Oral Surg. 23:557 (June) 1937.

17. Wheeler, R. C. Textbook of dental anatomy and physiology. Philadelphia, Saunders Co., 1940.

18. Berdmore, T. A treatise on the disorders and deformities of the teeth and gums. London, author, 1770.

19. Schuyler, C. H. The effect of abnormalities of occlusion upon the temporomandibular joint and associated structures. Proc. D. Centenary, p. 303, 1940.

1. The movement of the condyle when the mandible moves from rest position to initial contact and full occlusion through an acceptable freeway space with the patient sitting in an upright position may be rotatory or translatory.

2. From the point of initial contact to full occlusion, where there was no cuspal interference, no movement of the condyle was exhibited.

3. In the cases studied showing no displacement, the type of movement shown was the same for both condyles of the same patient.

4. The 5 cases showing a movement of the condyle from initial contact to full occlusion were indicative of cuspal interference.

5. The cases indicative of a displacement did not show the corresponding movement for both the right and left condyles of the same patient when the mandible moved from rest position to initial contact and then to full occlusion.

6. Roentgenographically, evidence for the proximity of the anterosuperior surface of the condyle to any surface of the glenoid fossa or of the articular eminence was not sufficient to draw any conclusions.

Combination of antibiotics and fungicides used in treatment of the infected pulpless tooth

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The recent use of penicillin in the treatment of infected pulpless teeth has stimulated interest in the use of other antibiotics. The antibacterial spectrum of penicillin is insufficient to destroy all the organisms encountered in the infected root canal. While penicillin has a spectrum against a wide range of gram-positive organisms, it is not effective against most gram-negative organisms and certain strains of gram-positive organisms.

Antibiotics are selective in their action having a destructive effect only against certain bacteria. Since the infection of the pulpless tooth is composed of a great number of different organisms, it becomes evident that mixtures of antibiotics have to be used to destroy all the bacteria.

This paper is a clinical report on the comparative effectiveness of various antibiotics and combinations of antibiotics and fungicides that were used to sterilize infections in the root canal.

PROCEDURE

The tooth undergoing treatment was isolated under the rubber dam and the field was sterilized with untinted tincture of Metaphen followed by alcohol. Access to the root canals was obtained with sterile burs and instruments. A culture was taken prior to treatment by moistening a sterile paper point with brain heart infusion broth (Difco) fortified with penicillinase. The point was introduced as far into the

root canal as possible. One minute was allowed to elapse before the point was removed and placed in a tube containing 10 ml. of culture medium. It was felt that a moistened paper point had a better chance of picking up bacteria than a dry paper point. Cultures were incubated for seven days before being recorded as negative.

The canal was cleansed and enlarged in the routine fashion and the respective antibiotic or mixture of drugs being tested was introduced into the root canal. The canal was then double sealed for one week.

Root canals that were preoperatively negative were filled at the following visit if there was no pain or discomfort in the tooth. If pain was present, the tooth was filled at a subsequent visit after the pain subsided.

Studies were conducted by taking cultures preoperatively to determine whether bacteria were present. Only cases that were preoperatively positive were evaluated in this study. After two treatments, if the culture was positive, the organism was identified. Cases that required more than two treatments to obtain a negative culture were considered as failures. These were sterilized with other accepted germicides or fungicides.

PENICILLIN

In this group, a total of 97 cases was studied. The first 53 cases (Study 1) were treated by using fresh aqueous solutions of amorphous penicillin. No preoperative cultures were taken on this group. The results as previously reported[1] showed that 70 per cent of the cases were sterilized with one treatment, using 25,000 to 50,000 units of penicillin. The remaining 30 per cent remained positive irrespective of the number of treatments (Table 1).

The second group of 44 cases (Study 2) were treated with potassium penicillin (600,000 units) in peanut oil. In this series, preoperative cultures were taken. The results showed that 68 per cent of the cases were sterilized in one or two

1. Bender, I. B. Penicillin in root canal therapy: report of 53 cases. J.A.D.A. 34:99 (Jan. 15) 1947.

Table 1 • Results of a comparative study of various combinations of antibiotics and fungicides

Antibiotic study	Number of cases	Number of cases with preoperative positive cultures	Percentage of positive cultures	Number of treatments necessary to obtain negative cultures			Percentage of successful cases
				1	2	3 or more	
1. Penicillin (amorphous aqueous)	53	*	*	37	0	16	70
2. Penicillin in peanut oil	70	44	63	27	3	14	68
3. Streptomycin in propylene glycol	82	60	73	40	4	16	73
4. Penicillin, streptomycin in oil	60	37	62	21	7	9	76
5. Penicillin, streptomycin in propylene glycol	121	74	61	48	0	26	65
6. Streptomycin, chloramphenico	98	63	64	51	0	12	81
7. Streptomycin chloramphenicol and sodium undecylenate	36	25	69	23	1	1	96
8. Procaine penicillin, streptomycin, chloramphenicol, Na. caprylate	148	98	66	93	2	3	97

*Study No. 1 did not have preoperative cultures.

treatments. The resistant organisms identified in this group, after one or two treatments, showed the yeastlike organism or fungi to be present in 18 per cent; gram-negative organisms in 4.5 per cent, enterococci in 6.8 per cent, and streptococci (viridans type) in 4.5 per cent (Table 2).

The difference in the percentage of successfully treated cases when the aqueous or the oil suspension of penicillin was used was not significant. This difference may be attributed to the fact that preoperative cultures were taken in the second group and not in the first. The result of the second study, therefore, was a more accurate determination of penicillin action.

The penicillin in oil suspension had a distinct advantage in that it could be kept at room temperature and fresh solutions did not have to be made up. However, oil suspensions have a disadvantage in the filling of the root canal.[2]

One of the patients in the aqueous penicillin study manifested a sensitivity reaction to penicillin. This patient gave a history of being sensitive to penicillin. In a period of eight hours after administration of aqueous penicillin, the patient complained of an itching and exhibited a slight urticaria on the side of the face on which the tooth was treated. The skin eruption lasted for about 12 hours. This reaction was probably caused by penicillin which had leaked out into the periapical area.

STREPTOMYCIN

In this series (Study 3), a total of 60 cases that were preoperatively positive were studied. Seventy-three per cent of the cases were sterilized in one or two treatments using 1 Gm. of streptomycin calcium chloride in 1 ml. of propylene glycol.

The remaining 27 per cent of positive cultures showed the presence of fungi, enterococci and streptococci (viridans type) organisms in pure and mixed cultures (Table 2).

Table 2 • Distribution of organisms found in the comparative study of the use of mixtures of antibiotics and fungicides in the treatment of the infected pulpless tooth

Organism	Study No. 2	3	4	5	6	7	8	No. of times recovered
Fungi	7	8	6	8	12	1	3	45
Enterococci	2	0	2	10	0	0	0	14
Fungi and enterococci	1	3	1	3	0	0	0	8
Streptococci (viridans type)	2	3	0	3	0	0	0	8
Streptococci (viridans type) and fungi	0	2	0	2	0	0	0	4
Gram-neg.	2	0	0	0	0	0	0	2
Total of pos. cultures	14	16	9	26	12	1	3	81

PENICILLIN-STREPTOMYCIN IN PEANUT OIL

In this series (Study 4), a total of 37 cases were studied. Seventy-six per cent were sterilized in one or two treatments. Nine cases, or 24 per cent, failed to respond to treatment. The organisms identified from the positive cultures were yeastlike organisms and enterococci.

The suspension was made according to the formula of Grossman:[3] 1 Gm. of streptomycin calcium chloride and 1,000,000 units of potassium penicillin in 2 milliliters of peanut oil.

PENICILLIN-STREPTOMYCIN IN PROPYLENE GLYCOL

In this series (Study 5) 74 cases were studied in which 48 cases, or 65 per cent,

2. Bender, I. B., and Seltzer, S. Use of penicillin-streptomycin in the treatment of infected pulpless teeth. Oral Surg., Oral Med. & Oral Path. 3:1070 (Aug.) 1950.

3. Grossman, L. I., and Stewart, George G. An effective penicillin-streptomycin suspension for endodontic treatment. Oral Surg., Oral Med. & Oral Path. 2:374 (March) 1949.

were sterilized in one treatment.[4] The 34.8 per cent of positive cases showed a high incidence of the enterococci organisms both in pure and mixed cultures. The enterococci were recovered in pure form 10 times, the enterococci and fungi in mixed culture, 3 times. The fungi were present in pure form 8 times, fungi and streptococci (viridans type) 2 times and the streptococci (viridans type) 3 times in pure form.

The difference in the percentage of successfully treated cases of the two penicillin-streptomycin studies, although not statistically significant, may be attributed to the fact that penicillin is not stable in propylene glycol and, therefore, did not exercise the antibacterial effect on some of the organisms. In addition, it is possible that the organisms developed a resistance to penicillin because of its reduced potency. Organisms also develop resistance to streptomycin more readily.

STREPTOMYCIN-CHLORAMPHENICOL

In this series (Study 6), 63 cases with preoperative positive cultures were studied. Fifty-one cases, or 81 per cent, were sterilized in one treatment. The only organisms recovered were the fungi in pure culture, 12 times.

This combination of antibiotics was effective against all the bacteria encountered in this group. It appeared that the antimicrobial spectrum of chloramphenicol and streptomycin was capable of destroying every type of organism encountered in the root canal with the exception of the fungi.[5] In addition, both of these compounds are stable at room temperature and are soluble in propylene glycol.

It was noted, however, that in 3 patients exhibiting periodontitis, pain persisted for about 48 to 72 hours. This may be because the chloramphenicol was primarily bacteriostatic in its action and hence did not exercise a rapid killing effect such as is usually exhibited with penicillin. Cultures taken at the time of pain were negative. These cultures, however, may have been false negatives because there is no known inactivator for chloramphenicol that can be added to the culture media. It has been shown that 0.32 mcg. per milliliter of chloramphenicol will inhibit *Streptococcus fecalis*.[6] Therefore, the transference of a paper point from the root canal into 10 ml. of broth may not be sufficient to dilute the residual bacteriostatic activity of chloramphenicol. As a result, a false negative culture could be obtained.

The foregoing combination was made by suspending 1 Gm. of streptomycin and 1 Gm. of chloramphenicol in 2 ml. of propylene glycol.

STREPTOMYCIN-CHLORAMPHENICOL-SODIUM UNDECYLENATE

The chloramphenicol and streptomycin combination resulted in the elimination of all resistant bacterial forms. Only the fungi remained. The addition of a chemical fungicide, sodium undecylenate, eliminated the presence of the yeastlike organism.[7]

In 25 cases with preoperative positive cultures (Study 7), 23 cases were sterilized in one sterilization treatment and one case required two treatments. In the only case that was positive, a yeastlike organism was identified. It can be seen from Table 1 that this combination was 96 per cent effective using the culture as the criterion.

Three patients manifested a slight periodontitis. Whether this condition was

4. Seltzer, S.; Bender, I. B., and Christian, C. Treatment of penicillin-streptomycin resistant organisms in the root canals of infected pulpless teeth. Oral Surg., Oral Med. & Oral Path. 3:802 (June) 1950.

5. Bender, I. B., and Seltzer, S. Chloromycetin-streptomycin therapy in endodontics. Oral Surg., Oral Med. & Oral Path. 3:1279 (Oct.) 1950.

6. Seltzer, S., and Bender, I. B. The use of chloramphenicol (chloromycetin) for killing some penicillin-streptomycin resistant organisms encountered in infected root canals. J. D. Res. 29:825 (Dec.) 1950.

7. Seltzer, S., and Bender, I. B. The addition of a fungicide to an antibiotic mixture for use in endodontics. In press.

caused by mechanical trauma or chemical irritation of the sodium undecylenate was not determined.

This combination of drugs was made by adding 500 mg. of sodium undecylenate, 1 Gm. of streptomycin and 1 Gm. of chloramphenicol to 2 ml. of propylene glycol.

PENICILLIN-STREPTOMYCIN-CHLORAMPHENICOL-SODIUM CAPRYLATE

In this series (Study 8), 98 cases that were preoperatively positive were studied. This combination was the most effective of all that were tested. Ninety-three root canals were sterilized in one treatment. Two required two treatments and 3 needed three or more treatments. The organisms present in the culture from the last 3 cases were identified as fungi. These were sterilized by flushing the canal with a 25 per cent aqueous solution of sodium caprylate. In all of the 3 cases, leakage of the temporary seal was suspected. Why only the fungi should be present when there is a leak in the seal cannot be answered now. It is a subject of another investigation.

The mixture of antibiotics and fungicide was prepared as follows: 200 mg. each of streptomycin (chloride), chloramphenicol (Chloromycetin) and sodium caprylate were placed in a sterile mortar. These powders were well triturated for 10 to 15 minutes. To this was added a commercially available 1 cc. aqueous suspension of 300,000 units of procaine penicillin G. The entire mass was again triturated for five minutes with a sterile pestle until a homogeneous mass was obtained. The suspension was then transferred with a small sterile spatula to a discharged procaine carpule from which one of the rubber plungers had been removed. The paste was tapped or vibrated into the carpule. The rubber plunger was then replaced and the carpule was inserted into a standard procaine syringe. A needle, such as is used in discharging hydrocolloid, was attached to the syringe. The antibiotic paste was applied in the root canal by ejecting into the canal. Reamers or files were then used to bring the material into intimate contact with the walls of the canal. A blunt paper point was then placed in the canal and the pulp chamber was double sealed with gutta-percha and cement. The patient was dismissed for two to seven days.

This combination of antibiotics and fungicide has been proved to be stable and effective for at least one year at room temperature without too much loss in potency. These drugs are also nonirritating to the periapical tissue.

Aqueous suspension of procaine penicillin G was selected because it was found to be stable for one year at 25°C., losing only 6 per cent of its potency. The ordinary potassium penicillin G, on the other hand, is not stable in any of the known aqueous or semiaqueous menstruums. Potassium penicillin G, suspended in various agents; namely, carboxymethyl cellulose, propylene glycol, Tween 80, colloidal bentonite and DC-200 (3 centistokes), was tested for stability. It was found that at the end of one month 90 to 99 per cent of its antibacterial action had been lost, regardless of the suspending agent.

Streptomycin and chloramphenicol are both relatively stable drugs. Sodium caprylate was selected because it yielded slightly larger zones of inhibition than sodium undecylenate under *in vitro* tests. Also, clinically, Grossman[8] found it to be nonirritating to the periapical tissue in a large number of cases. Sodium caprylate also was found to exert a bactericidal action on many gram-positive organisms.

It can be observed from Table 1 that, as the antimicrobial spectrum was increased by adding other antibiotic agents, the percentage of negative cultures increased. Whereas penicillin was effective

8. Grossman, L. I. Personal communication.

in 68 to 70 per cent of the cases, the addition of streptomycin increased the percentage of successful cases by eliminating the gram-negative organisms. These were present in about 6 to 8 per cent of the cases. In addition it has been shown that a synergism occurred between penicillin and streptomycin against certain microorganisms.[9]

The combination of streptomycin and chloramphenicol eliminated all the bacteria. The antibacterial spectrum of both antibiotics was great enough to destroy all the bacterial forms encountered in the root canal. The only remaining positive cultures, 19 per cent, were all fungi or yeastlike organisms. When a fungicide such as sodium undecylenate was added to this combination, it was 96 per cent effective.

Penicillin was added to the combination because clinically it was found that it eliminated the periodontitis more rapidly. Whereas in cases of periodontitis where streptomycin and chloramphenicol were used, the periodontitis lasted for 48 to 72 hours, with the addition of penicillin the periodontitis disappeared in about eight hours. Also, the addition of another antibiotic such as penicillin introduced a synergistic effect between the penicillin and streptomycin against certain organisms and widened the antibacterial spectrum of the combination.

Conversely, it is true that certain antibiotics in combinations may be antagonistic in action against certain organisms or may interfere in their antibacterial effect. Jawetz[10] and co-workers have shown that penicillin and chloramphenicol in combination are less effective than penicillin by itself against certain enterococci. This interference of action was manifest for the first 48 hours but after that time the penicillin and chloramphenicol exerted a greater killing effect than that of penicillin alone. It was also shown that penicillin and streptomycin exerted a synergistic effect on the same organism. The effect of chloramphenicol on penicillin in the presence of streptomycin was not determined.

Clinically, the results have shown that

9. Bender, I. B., and Seltzer, S. The synergistic effect of penicillin-streptomycin and its application in the treatment of infected pulpless teeth. J.A.D.A. 40:169 (Feb.) 1950.

10. Jawetz, E.; Gunnison, J. B., and Coleman, V. R. The combined action of penicillin with streptomycin or chloromycetin on enterococci. Science 111:254 (March 10) 1950.

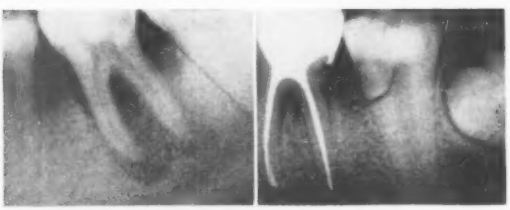


Fig. 1 • Left: Patient, aged 15, was treated for an acute dentoalveolar abscess on lower left first molar. Canals were sterilized in one sterilization treatment with a combination of antibiotics. Right: Bone repair as manifested at the end of two months

Fig. 2 • Left: Patient, aged 17, treated for a subacute dentoalveolar abscess with a fistula manifesting itself on the buccal side. Note the extensive area of rarefaction. Right: Area of bone rarefaction considerably reduced, three months after antibiotic treatment

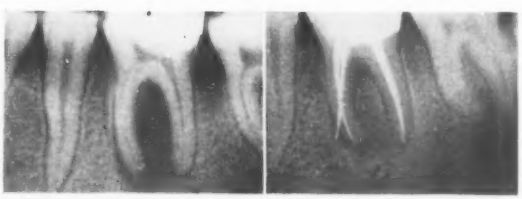
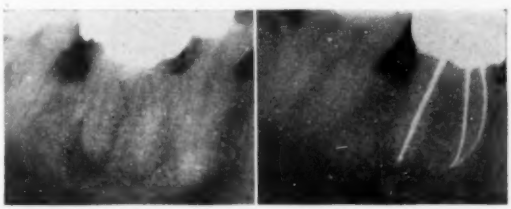


Fig. 3 • Left: Chronic abscess of lower first molar of patient 14 years of age. Despite the fact that distal apex is eroded or incompletely calcified, root therapy was performed. Center: Shows evidence of bone repair at the end of two months: Right: Bone repair at the end of five months

Fig. 4 • Left: Chronic abscess of first molar of patient 47 years of age. Right: Complete bone repair after four months following antibiotic treatment



the combination of penicillin, streptomycin, chloramphenicol and a fungicide was an effective treatment. The culture results substantiated the favorable clinical findings. The above "shotgun" treatment required an average of only 1.1 treatments to obtain a negative culture.

Recently attention has been called to penicillin reactions or sensitivity. These reactions can occur during or within a few days following its administration. Systemic reactions resembling anaphylaxis sometimes develop several weeks after therapy. Reactions are usually manifested by pruritus, localized or generalized urticaria. Sometimes it is accompanied by dermatitis, arthralgia, edema, sore throat and nausea.[11]

Sensitivity occurs in only 2 to 5 per cent of persons receiving the drug.[12] Most reactions are not serious but if present the penicillin should be discontinued if the sensitivity cannot be readily controlled, or when the reactions are more serious than the condition treated. The adjunctive use of an antihistaminic compound frequently helps to control the reactions. It has been reported that the use of procaine penicillin G results in a lower incidence of hypersensitivity than do other forms of penicillin.

In our study of 452 cases receiving penicillin, only one case manifested a sensitivity reaction. The complication, therefore, can be considered insignificant. However, with the more extensive general use of penicillin more patients may develop penicillin sensitivity. If patients give a history of penicillin sensitivity, then the combination of chloramphenicol-streptomycin and a fungicide can be used.

From Table 1 it can be seen that any combination of two antibiotics and a fungicide can give equally favorable results.

11. Brown, E. A. Progress in allergy: reactions to penicillin: review of literature 1943-1948. Ann. Allergy 6:723 (Nov.-Dec.) 1948.

12. Peck, S. M. and others. Clinical problems in penicillin sensitivity. J.A.M.A. 138:631 (Oct. 30) 1948.

Fig. 5 • Upper left: Chronic abscess with fistula present on labial side. Upper right: Two weeks after conservative treatment with trial silver point in place. Lower left: Six months after treatment. Lower right: One year after treatment with antibiotics

In most of the patients exhibiting large areas of rarefaction there was evidence of bone regeneration as early as the second week. In most instances the radiolucent area was completely filled in and the lamina dura was intact after two or three months. The accompanying roentgenograms (Fig. 1 to 5) demonstrate the rapid repair that follows the use of antibiotics as a means of sterilization.

SUMMARY AND CONCLUSIONS

1. The effectiveness of various antibiotics and combinations of antibiotics and fungicides in root canal infections has been determined in eight different studies.

2. The least effective treatment was the use of penicillin alone. This was effective in only 68 to 70 per cent of the cases.

3. The most effective treatment was the use of a combination of procaine penicillin G, streptomycin, chloramphenicol and sodium caprylate. This combination yielded a negative culture in 97 per cent of the cases after an average of 1.1 treatments.

4. The antibiotic and fungicide combination are stable for one year.

5. A method of treatment was suggested for those patients exhibiting penicillin reactions.

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Knowledge Brings Advance • In truth, we advance far by the harmonious assembling of facts made known by many observers and writers. *C. H. Mayo, "The Cancer Problem," Canadian Medical Association Journal 8:786, 1918.*

Role of prophylactic procedures in the treatment of periodontal disease

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It is now generally accepted that the etiology of periodontal disease is complex and that usually many causative factors are involved. The etiologic factors can be divided into two main groups: local irritations and predisposing or systemic disorders. Actually all cases of periodontal disease result from a combination of factors belonging to both groups; in cases where the tissues involved have good resistance only a slight pathologic change may result from rather severe local irritation, whereas in other cases a relatively mild local irritation inflicted on tissues already weakened by some systemic disorder may cause severe involvement.

No one denies the fact, however, that removal of local irritants is essential in the treatment of every case of periodontal disease. Whether the technic employed is limited to prophylactic procedures or includes surgical intervention, occlusocondylar harmonizations, splinting of teeth, dietary supplementation or other measures, prophylactic procedures must be carefully followed before satisfactory results can be obtained.

Since prophylaxis is defined as the "prevention of disease" or "guarding from disease," technically most dental operations are "prophylactic," for operative restorations are placed to prevent pulpitis, bridges are placed to prevent malocclusions, extractions are made to prevent infection. Therefore, it is wise to consider such routine dental operations as "preventive." By common usage a prophylaxis in dentistry is usually considered as referring to procedures designed to make the exposed surfaces of teeth perfectly smooth and free from all calcareous deposits, stains and debris. In addition, many dentists include under the term prophylaxis the removal of overhanging margins of restorations, correction of faulty contacts and improper contours of teeth and restorations and relief from excessive stresses on teeth.

To avoid misunderstanding, it should be emphasized that prophylactic procedures alone are inadequate for obtaining maximum results in far advanced cases. In fact, a plan of treatment for all cases of periodontal disease should include the following: (1) prophylactic procedures by which all local irritants are removed or corrected; (2) performance of all dental operations which help

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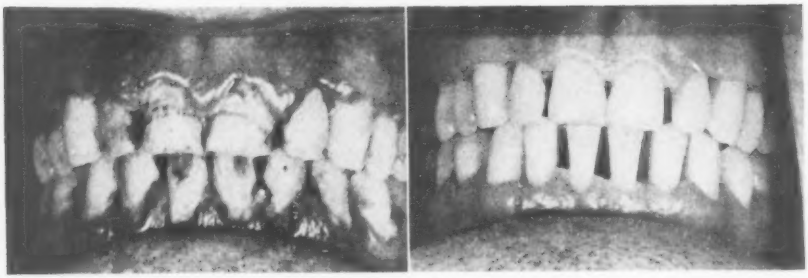


Fig. 1 • Teeth and gingival tissues of white male, about 35 years of age, before and after prophylaxis. Good response but apparent need for prolonged home care to maintain good oral hygiene and to help recontour gingival tissues

maintain supporting tissues in a healthy condition; these operations include occlusal equilibration, correction of improper contact areas, contouring of poor dental restorations and perhaps a gingivectomy to reduce pockets that are so deep that oral health cannot be maintained; (3) correction, when necessary, of the diet and of all systemic conditions which tend to interfere with the health of the oral tissue; (4) education of patients in the importance of and the technics for maintaining the supporting tissues of the teeth in a healthy condition by adequate home care; (5) regular and frequent follow-up examinations and treatment.

This paper is limited to a discussion of prophylactic procedures in the treatment of periodontal disease.

SCOPE AND LIMITATION

Prophylactic procedures are indicated for the following stages of treatment:

1. As procedures to prevent periodontal disease.

Although no satisfactory statistics are available, every clinician is convinced that periodontal disease usually can be prevented by careful prophylactic procedures routinely performed before damage has occurred to the tooth attachment apparatus. Adult patients should be seen at regular intervals so that calcareous deposits can be removed and the oral hygiene of the patient kept at a high level. Some patients must be seen every three months, but twice-yearly appointments are adequate for most patients.

2. As an essential part of the treatment of periodontal disease.

Cases of gingivitis due to local irritation and mild cases of periodontitis can be treated satisfactorily by simple prophylactic procedures. If pathologic pockets do not exceed 3 mm. and in some cases 4 mm., treatment by prophylaxis alone produces adequate results (Fig. 1, 2, 3).

3. In the maintenance phase of periodontal disease treatment.

After completion of treatment by any technic, prophylactic procedures are needed to maintain healthy gingival tissues. This maintenance phase is most important if the supporting tissues are to remain free from inflammation. Treatment for periodontal disease can be considered successful only if the gingival tissues remain firm, well stippled, pale coral pink in color, quite insensitive and resistant to trauma and gripping the teeth firmly. If within a few weeks after treatment the gingival tissues become

Fig. 2 • Oral tissues of white female, aged 46, before and after simple prophylactic procedures. Response only fair because patient was uncooperative

inflamed and bleed easily and if the teeth become mobile, the treatment must be labeled a failure. Only with good prophylactic care can oral health be maintained for long periods of time.

TECHNIC

Just prior to World War II, Willman[1] reported that almost a thousand different instruments had been designed to remove calcified deposits from teeth and to make the hard tissue side of pathologic pockets smooth. This immense variety simply means that no one set of instruments has been designed which can remove all deposits from all surfaces of teeth to the complete satisfaction of all dentists. As Willman states, "It is the operator that scales the teeth, not the instrument."

Certainly, no one instrument has yet been designed which can scale efficiently and without undue damage all surfaces of all teeth; therefore, a set of instru-

1. Willman, W. P. Periodontia. New York, National Medical Book Co., 1938, p. 193.

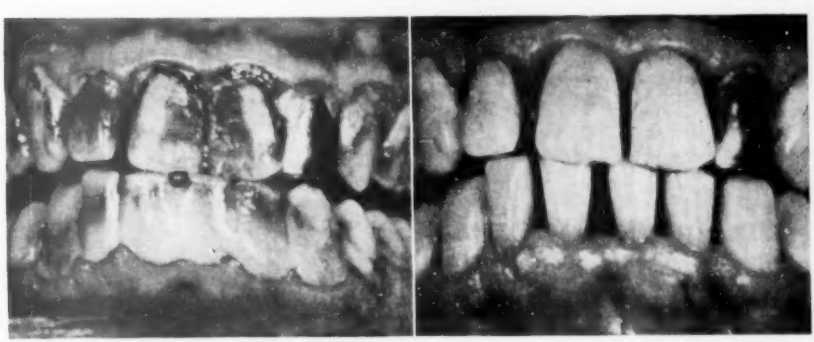


Fig. 3 • Oral tissues of white male, aged 58, before and after treatment. Response fairly good although the periodontitis was far advanced

ments should be chosen to suit the operator and the case to be treated.

The instruments selected should meet the following requirements: (1) The scalers should be delicate so that they can be inserted into deep pockets without damaging the soft gingival tissues unduly. (2) The scalers should be so designed that at least one of them can reach easily each exposed surface of each tooth. (3) The scalers should be of a type which can be sharpened easily.

The following set of instruments meets these requirements and is considered minimal for a routine prophylaxis:

1. Blunt explorers similar to the Black periodontal explorers, no. 1 and no. 2 (Fig. 4A).

2. A set of about eight "pull-cut" scalers similar to the McCall scalers, no. 2 to no. 9 (Fig. 4B).

3. A set of small sickle scalers similar to the Jacquette no. 1, no. 2 and no. 3 (Fig. 4C).

4. Push-cut scaler similar to the Darby-Perry Special Scaler no. 1 or the Black no. 9 and no. 10 (Fig. 4D).

5. A set of root files similar to the Schraeder, no. 1 to no. 8 (Fig. 4E).

6. Porte-polisher to be used with fine flour of pumice.

7. Dental tape.

No special claim for superiority of these instruments is indicated since, doubtless, other instruments are equally efficient. This selection, however, does meet the requirements for an adequate set of instruments for removing all deposits on teeth.

Time does not permit nor is it necessary to describe the use of these instruments. The technic of their use can be

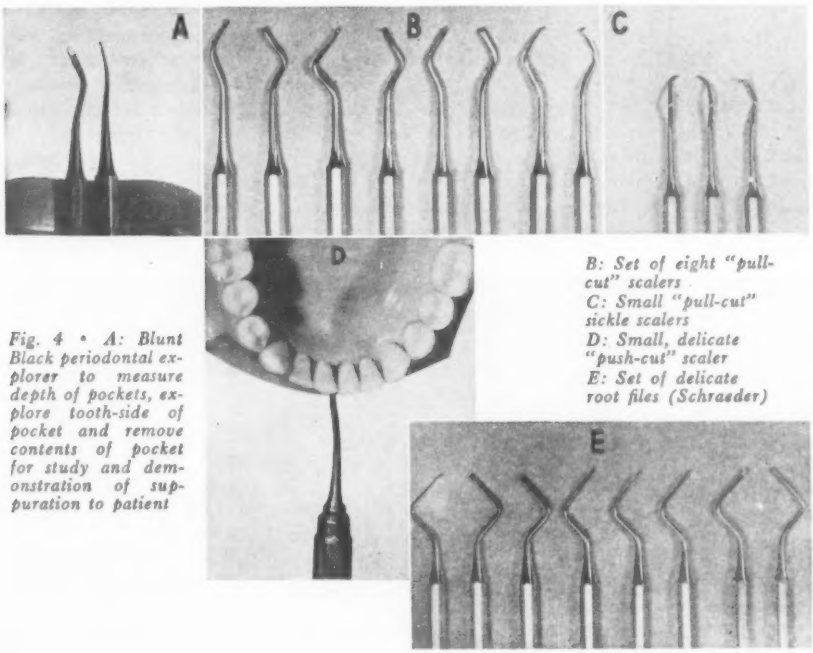


Fig. 4 • A: Blunt Black periodontal explorer to measure depth of pockets, explore tooth-side of pocket and remove contents of pocket for study and demonstration of suppuration to patient

B: Set of eight "pull-cut" scalers
C: Small "pull-cut" sickle scalers
D: Small, delicate "push-cut" scaler
E: Set of delicate root files (Schraeder)

outlined briefly as follows: (1) Pathologic pockets are explored carefully with the Black explorers, and the contents of the pockets are noted. (2) Each surface of each tooth is carefully scaled to the base of each pocket so that the hard tissue side of the pocket is free from calculus and debris. This procedure should be followed carefully and thoroughly, one tooth at a time; care must be taken to select the appropriate scaler. (3) Root files are used to complete the removal of deposits on root surfaces. (4) Each surface of each tooth is polished carefully. Exposed surfaces can be polished with soft rubber cups and more inaccessible areas with dental tape and the porte-polisher. (5) All teeth are scaled and the surrounding soft tisses are painted with a mild astringent similar to iodine and zinc iodide glycerite, N.F. (6) The mouth is rinsed with a warm rinse. A syringe with a blunt needle can be used to flush out deep pockets. (7) The mouth is examined carefully for abnormal contacts, overhanging restorations, proximal caries and other unfavorable conditions. These local irritants should be corrected. (8) Occlusion is studied to locate premature contacts and abnormal stresses on teeth, indicated by increased mobility and mandibular shifts. Such deviations should be corrected. (9) Instruction is given regarding home care required for the case being treated. (10) Appointments are made for subsequent treatments.

The value of epithelial curettements or epithelial solvents to destroy the epithelial lining of the pathologic pocket has not been established scientifically. There seems to be no contraindication to such technics, however, if they are used carefully.

AIRBRASIVE TECHNIC

Development of the new Airdent unit has given dentistry another method of removing deposits from teeth. The

Fig. 5 • Stain later removed by airbrasive technic from one quadrant of mouth of male, aged 24

stream of abrasive (dolomite) from the unit removes all stains and calcified deposits from exposed surfaces of teeth (Figs. 5, 6). Unfortunately, it is not adaptable for the removal of subgingival deposits; scalers must be used in pathologic pockets.

Since deposits of calculus are often almost as hard as dentin or cementum, any abrasive material which can remove calculus may harm the tooth. The Airdent must be used with caution since even the mild abrasive used removes some of the tooth surface, particularly if the nozzle of the unit is moved closer than 5 mm. to the tooth and is held on one spot. If the nozzle is held 10 to 15 mm. from the tooth and is moved back and forth slowly, damage to the tooth is negligible. Tests at Indiana University School of Dentistry, however, indicate that the surface of the tooth loses its luster rapidly. Bailey and Phillips,[2] using an instrument designed to measure the amount of light reflected from the surface of a tooth (reflectometer), found that the airbrasive made the teeth tested dull although polishing the teeth for a

2. Bailey, L. R., and Phillips, R. W. Effect of certain abrasive materials on tooth enamel. J. D. Res. 29:740 (Dec.) 1950.

Table • Effect of airbrasive technic on luster of teeth

Distance of nozzle from tooth	Average change in luster from original		
	Airbrasive	5 sec.* polish	10 sec.* polish
5 mm.	−48	−5.5	−0.5
10 mm.	−48	−4.0	−1.0
15 mm.	−46	−3.0	−1.0

*Polished with rubber cup and levigated alumina.

few seconds with a rubber cup quickly restored the original luster (table).

The Airdent, therefore, is of little value to the periodontist since it removes only exposed deposits and teeth so cleansed must still be polished in the routine manner in order to give them a high luster.

DISCUSSION

If the prophylactic procedures are followed carefully in a case of periodontitis, the inflammation in the supporting tissues gradually disappears since the soft tissues around the teeth have an excellent blood supply and include all the elements needed for healing. The soft tissue side of the deep pockets is quickly covered with epithelium, which protects the connective tissue from bacterial invasion and at the same time forms a barrier to reattachment of periodontal membrane by deposition of a new layer of cementum.

From a theoretical point of view, if this epithelial barrier could be completely destroyed, reattachment could follow. Experimental evidence suggests that true reattachment can occur in cases where the gingival tissues are not inflamed but not if there is severe gingival inflammation.[3] Although many authors have reported clinical cases of reattachment of periodontal membrane in deep pathologic pockets, acceptable scientific evidence is scarce. Clinical experience has convinced the authors that true periodontal membrane reattachment seldom occurs; usually a deep pocket heals because the epithelial lining is good and because the tissue grips the tooth tightly.

In cases of advanced periodontal disease where there are pockets deeper than 5 mm., the soft tissues lining the pockets often do not return to normal nor do they remain long free from inflammation if only prophylactic procedures are followed. One reason is that

3. Ramfjord, Sigurd. Experimental periodontal reattachment in Rhesus monkeys. J. Periodont. 22:67 (April) 1951.

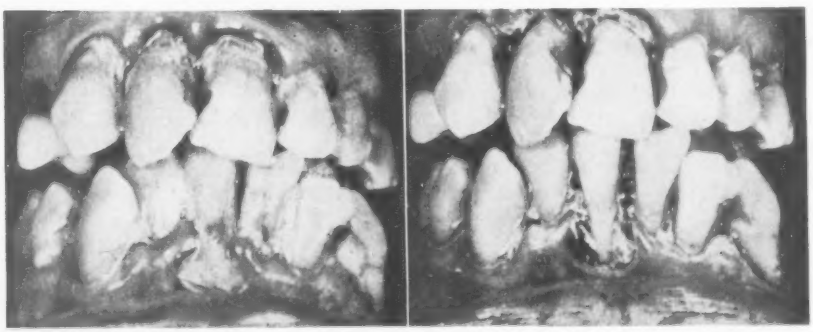


Fig. 6 • Oral tissues before and after removal of supragingival deposits of calculus by airbrasive technic

it is difficult to make the hard tissue side of the pocket perfectly smooth. Since the presence of even tiny spicules of calculus interferes with complete epithelization of the pocket, exposed connective tissue remains infected and inflamed.

A second reason is that even if home care is excellent, the gingival tissues making up the soft tissue side of a deep pathologic pocket remain flabby and do not grip the tooth tightly. Since the resultant space is an efficient incubator for bacteria and a trap for debris, the inflammatory process persists because of the local irritation.

Such a case requires more energetic treatment, a gingivectomy or some other technic for eliminating pathologic pockets.

CONCLUSIONS

Perhaps the most important axiom in the treatment of any disease is: remove the cause. Since local irritations are most frequently present in periodontal disease, their removal by carefully performed prophylactic procedures is indicated. In mild cases prophylaxis alone is adequate treatment; in severe cases prophylaxis should be accompanied by other methods of treatment.

Interpretation of Roentgenograms • The radiographs heed no specialty. He who takes the responsibility of interpreting them must have knowledge not only of his specialty but also of the radiology of all structures in the area, widely separated though they may be anatomically. A predominant interest in any one system may blind the observer to other evidence obvious to those who seek it. Even radiologists who are aware of the possibility, suffer in this way, and they come to recognize, with experience, shadows and appearances that they did not previously see. *James F. Brailsford, M.D., "Factors Which Influence the Value of a Radiological Investigation," Lancet No. 6710:679 (April 5) 1952.*

Practical use of the space maintainer

James J. Kennedy, D.D.S., M.S.D., Chicago

The problem of space retention in the mouths of children has been considered by members of the dental profession for many years. A great deal has been written concerning abnormal growth and development of the jaws and related structures and the importance of space maintainers in preventing the abnormal relationships. Certainly, the use of such appliances needs no further justification.

Certain areas of the mouth are less liable to suffer from premature loss of deciduous teeth. When upper anterior deciduous teeth are lost prematurely, the least unfavorable results occur. Just prior to the eruption of the permanent central and lateral incisors, lateral development is taking place in this area. Although there is a tendency toward drifting, this lateral growth compensates for it. Usually, except for esthetic reasons or the possibility of a speech defect, a space maintainer is not necessary in this area.

Next in order of importance is the premature loss of the deciduous first molars. An appliance is more often needed in these instances. The premature loss of second deciduous molars without subsequent maintenance of space is most disastrous.

Dewey[1] stated in 1925 that if he knew the time a given deciduous tooth had been lost, he could positively predict the malocclusion that would develop by the time the child was 12. Lewis,[2] in 1929, made a study of a group of children in Michigan and stated that there was a difference in rate of closure, that it was greater in posterior segments and varied from one individual to another.

Brandhorst[3] stated in 1932 that 20 per cent of premature extractions caused malocclusion. Willett,[4] in 1933, expressed the belief that 26 per cent was a closer figure, and Foster[5] stated the figure went as high as 65 per cent. Cohen[6] made an extensive study of the problem in 1941. He found that when first deciduous molars were lost prematurely, the arch development apparently was normal in 94 per cent of the children. The age at which the tooth was lost appeared to have no bearing on the closure of space. It was found that when second deciduous molars were prematurely lost, only 60 per cent of the mouths showed no ill

Presented before the Section on Pedodontics and Oral Hygiene, ninety-second annual session of the American Dental Association, Washington, D.C., October 17, 1951.

Assistant professor of pedodontia, Northwestern University Dental School.

1. Dewey, Martin. Deciduous teeth as factors in normal development. Internat. J. Orthodont. 11:898 (Oct.) 1925.

2. Lewis, S. J., and Lehman, I. A. Observations on growth changes of the teeth and dental arches. D. Cosmos 71:480 (May) 1929.

3. Brandhorst, O. W. Promoting normal development by maintaining the function of the deciduous teeth. J.A.D.A. 19:1196 (July) 1932.

4. Willett, R. C. Premature loss of deciduous teeth. Angle Orthodont. 3:106, 1933.

5. Foster, H. R. How to practice dentistry for children as preventive orthodontics. Internat. J. Orthodont. 19:1031 (Oct.) 1933.

6. Cohen, J. T. The selection of cases for space maintainers. North-West Den. 20:75 (April) 1941.

effect so far as arch development was concerned. Forty per cent showed closure of space. He further stated that the age at which the tooth was lost apparently had no effect on the loss or retention of space. There is a natural decrease in space needed by the succedaneous teeth of from 1 to 2 mm. in the cuspid and bicuspid region which allows some mesial drifting of the first permanent molar without crowding the second bicuspid.

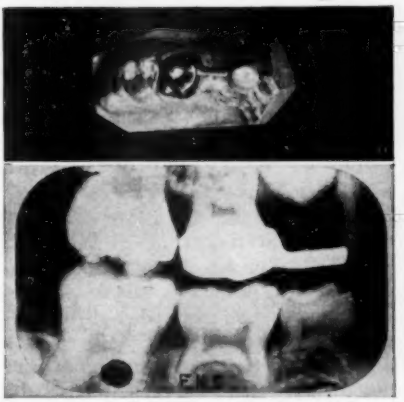


Fig. 1 • Above: Appliance used to maintain space where first deciduous molar has been prematurely lost. Below: Appliance maintaining space for first bicuspid

SPACE MAINTAINERS

Appliances for space maintenance may be divided generally into three classes: fixed, removable and fixed removable. An appliance which seems suitable for various typical clinical situations will be described.

Type Case 1 • If a single deciduous molar is lost prematurely and the adjacent teeth are present both mesially and distally, the simplest type of space maintainer would consist of a cast crown on one tooth with a 14 gage round wire spanning the space, soldered to the crown at one end and meeting the contact point of the tooth on the opposite side of the space, as described by Willett (Fig. 1). If the second deciduous molar is lost, the first deciduous molar may be crowned. If the first is lost, the second is crowned when possible. Modifications of these bar type maintainers are described in the literature.[7] They range from this simplest form to types with multiple abutments and stress-breakers.

An overlay crown cast of hard gold is preferable to an orthodontic band principally because of the added retention which can be secured with the crown. It is wise to avoid the use of clasps whenever possible in constructing a fixed maintainer. The clasped tooth frequently becomes carious under such conditions and it seems plausible that in a mouth where a tooth has been lost prematurely, higher than average susceptibility to caries may be expected.

Construction of an overlay for maintainers should be fairly simple since it is rarely necessary to make any preparations on abutment teeth. An exception is where undercuts may require moderate cutting of the mesial or distal surfaces of the deciduous cuspid. Procedures for the construction of the crown are as follows: An impression of the individual tooth to be crowned is made in a modeling compound and is relined with a slight amount of elastic compound. Any technic which assures a satisfactory impression is acceptable. The model is poured in a suitable casting investment. One millimeter of the gingival material is trimmed, following the contour of the natural surface as nearly as possible. The finished crown will then be allowed to pass slightly below the crest of the free gingiva in the mouth. A coat of wax is applied to the model approximately the

7. Brauer, J. C. Dentistry for children, ed. 2. Philadelphia, P. Blakiston's Son, 1947, p. 348-359.

thickness of 30 gage casting wax. The tips of the cusps in wax are removed with a sharp knife, exposing the underlying investment material.

The model is then cast in hard gold and tried in the mouth. The gingival margin is finished to a feather edge. An impression is taken of the crown in place including the space and the two adjacent teeth. An investment model is poured and the remainder of the appliance assembled. It is possible to cast this type of maintainer in one piece when desired.

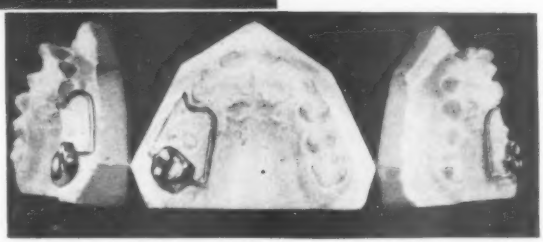
Type Case 2 • If two proximating deciduous molars are lost prematurely, the simplest appliance consists of a cast overlay crown on the first permanent molar with a double wire extending mesially, buccally, and lingually, contacting the deciduous cuspid at its cervical line (Fig. 2). This wire, which should not be heavier than 18 gage, is closely adapted to the soft tissue. Bicuspids may then erupt within the loop and the wire may be removed when the bicuspids are sufficiently erupted to prevent mesial drift of the first molar. One disadvantage of this crib type maintainer is its lack of ability to prevent elongation of the dental units of the opposing arch. Other variations of this type of space maintainer are described in the literature, but each one has its drawbacks.[8] McBride[9] and others recommend the crib type also to maintain a single tooth space.

Type Case 3 • If a second deciduous molar has been lost prematurely and the first permanent molar is unerupted, as frequently occurs, it becomes necessary to make an appliance which is inserted into the soft tissue (Fig. 3). A crown is made for the first deciduous molar with a 14 gage round wire soldered to the distal surface in a horizontal position. This wire is bent at right angles at a point just above the marginal ridge of the unerupted permanent molar. The area is anesthetized and an incision is made into the tissue through which the wire is

8. Hogeboom, F. E. Practical pedodontia or juvenile operative dentistry and public health dentistry, ed. 4. St. Louis, C. V. Mosby Co., 1942, p. 251-255.

9. McBride, W. C. Juvenile dentistry, ed. 4. Philadelphia, Lea & Febiger, 1945, p. 271-275.

Fig. 2 • Left: Single cast overlay crown on first permanent molar



Right: Crib type maintainer for use where two deciduous molars are missing on one side. Bicuspids may be seen erupting inside wire loop

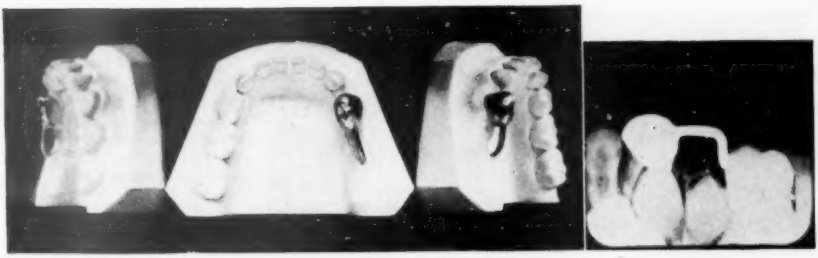


Fig. 3 • Left: Maintainer suitable for use where second deciduous molar has been prematurely lost and permanent first molar is unerupted. Bar enters tissue to guide unerupted permanent molar into normal position. Right: Roentgenogram of type of maintainer shown at left. Permanent molar is erupting along vertical bar

passed downward to rest nearly against the mesial surface of the unerupted permanent first molar. The appliance is then inserted. Roentgenograms are taken and a satisfactory relationship between the wire and the permanent molar is demonstrated before cementation. The first permanent molar should erupt vertically along this submerged wire. When its marginal ridge contacts the right angle bend, the wire extension into the tissue may be removed. The horizontal wire will then keep the molar from drifting mesially.

Type Case 4 • Occasionally the situation arises where there is premature bilateral loss of deciduous molars and the permanent molars have not erupted. The deciduous cuspid usually is not strong enough to act as an abutment for an extension spanning the space created by loss of two contiguous teeth. If two cuspids in the same arch are passively anchored together by an 18 gage lingual wire, a satisfactory appliance may be made. Since it might prove a hindrance to the growth and development of either arch to fasten two cuspid teeth together, this lingual wire must provide for expansion of the anterior segment by including a joint which will allow some movement of the abutment teeth. This expansion joint is easily supplied by inserting in the middle of the lingual wire a round tube which is soldered at one end to one segment of the wire. The other segment is merely inserted and can move out of the tube as growth brings about an expansion of the arch.

With this bilateral compound abutment established, extensions similar to those which would be used were the appliance unilateral are constructed. If both molars are bilaterally missing, 14 gage round wire extensions may run posteriorly and down into the soft tissues (Fig. 4). If a multiple extraction has been performed on one side only, a deciduous molar may be used as an abutment in conjunction with the opposite deciduous cuspid (Fig. 5).

Type Case 5 • In many instances where posterior teeth are lost on both sides of the arch and the first permanent molars are sufficiently erupted to act as abutments, a fixed removable lingual arch is a useful appliance (Fig. 6). Either orthodontic bands or cast overlay crowns may be used on the molars. An 18 gage round wire is contoured to the linguogingival surfaces of the remaining teeth and ridges. The arch wire is attached by means of a vertical half-round pin and tube on the lingual side of the abutment

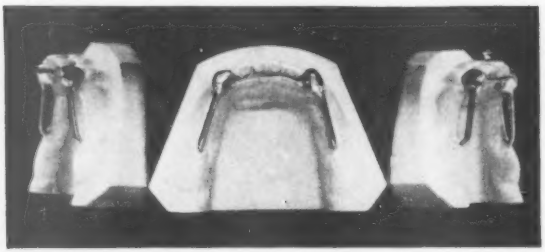


Fig. 4 • Bilateral type of maintainer to prevent mesial drift of both unerupted first permanent molars where all four deciduous molars have been prematurely lost

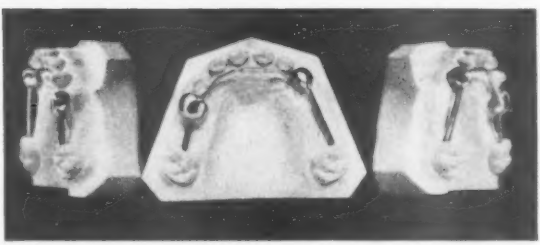


Fig. 5 • Bilateral maintainer using one deciduous molar and one deciduous cuspid as abutments. Expansion joint in lingual bar can be seen

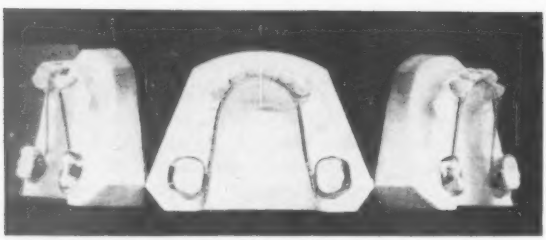


Fig. 6 • Fixed movable lingual arch appliance

with a suitable locking device to prevent displacement of the appliance by the patient. Auxiliary wires may be soldered to the arch wire to act as stops for the prevention of space closure wherever necessary. With such a device it is only necessary to remove the arch wire as alterations are needed without disturbing the aubtment teeth. It is therefore particularly advantageous in cases where the status of the remaining teeth is doubtful. The lingual arch maintainer also does not prevent extrusion of teeth in the opposing arch and, therefore, is particularly indicated where teeth are lost in the opposing arch.

Type Case 6 • In some instances where multiple premature loss of the decidous teeth occurs, a partial denture is a satisfactory way of maintaining space. The denture may be made with or without clasps, depending on the situation. If clasps are utilized it is often necessary for the clasped teeth to be crowned because of the lack of undercuts in the buccal and lingual contour of the deciduous teeth. A lug can be soldered to the buccal or labial surface of the crown near the gingival margin which will engage the clasp and prevent it from slipping occlusally.

In many instances it is not necessary

to use a metal framework in constructing a removable space maintainer. An effective device which includes the lingual bar and teeth can be constructed entirely of acrylic resin (Fig. 7). The occlusal surfaces can be carved in the wax model to articulate with the opposing teeth. Such an appliance is functional and economical.

In either instance, when constructing a removable maintainer with a saddle where the first permanent molar is unerupted, it is desirable to include a bead on the heel of the denture which will cause a compression of the tissues to the mesial of the unerupted tooth and prevent that tooth from erupting mesially. When the tooth erupts into proper position, this bead may be removed and the patient may continue to wear the appliance as a space maintainer.

Occasionally when deciduous incisor teeth are lost prematurely, it is well to maintain the space. This situation requires the use of a maintainer less often than with loss of teeth in any other part of the mouth. It is more likely that one will be needed in the lower arch than in the upper. For esthetic and phonetic reasons it may be necessary to find a substitute for missing maxillary incisors.[10]

A simple yet fundamentally sound appliance for such cases consists of a lingual arch wire soldered to molar bands with an acrylic tooth or a Steele's facing attached in the anterior segment. A removable horseshoe acrylic palate may be used with substitute teeth attached. A more complicated fixed movable appliance is occasionally indicated consisting of cast bands as attachments and porcelain or acrylic teeth with a midline joint to allow for expansion of the arch.

Modern technological developments in dentistry allow an increased number of designs for space maintainers, but all have their advantages and disadvantages.

Fig. 7 • Removable one piece acrylic partial denture. Occlusal anatomy of deciduous molars is carved in the acrylic

SUMMARY

While it is difficult to calculate the degree and incidence of malocclusion caused by premature loss of deciduous teeth, it is generally agreed that the judicious use of space maintainers is a necessity in the practice of dentistry for children. The intelligent selection of an appliance for a specific case requires that the operator have clearly in mind what service he expects to render in that particular case. It is important that he select a maintainer that will function adequately, will be relatively simple to make and will be easy for the patient to wear. Only under such circumstances will the use of space maintainers become a real part of the average dental practice.

10. Gardner, A. F. Dental, oral, and general causes of speech pathology. Oral Surg., Oral Med. & Oral Path. 2:742 (June) 1949.

Some periodontal considerations in partial denture planning

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In partial denture construction, much emphasis has been placed on impression technics, tooth forms, clasp design, and materials. Admittedly, these are important, but far too little attention has been given to the preliminary preparation of the mouth from a periodontal standpoint so that these partial dentures may be retained for extended periods of time. The dentist's obligation to the patient not only includes the insertion of a technically perfect partial denture, but also a reconstruction made to physiologic specifications and inserted in a mouth free of infection, and a mouth in which this infection-free condition can be easily continued.

Preparation of a mouth to receive partial dentures involves a number of considerations regarding the periodontal tissues; namely, the relation of the mandible and its teeth to the rest of the skull, the number and position of teeth in the individual arch, the type of supporting bone and the amount of loss, degree of tooth mobility, opportunity for food impactions, drifting and loss of tooth contact, length of tooth roots, pocket types and depths and mouth habits. In addition, there are many systemic factors which are extremely important. It must be remembered that both local and systemic factors are often involved, and that their degree of importance varies in each individual case. The systemic factor to be taken in consideration most frequently is the presence of nutritional deficiency diseases.

All of these factors should influence the type of treatment planned, whether certain teeth are removed or retained, and whether certain teeth or groups of teeth are reinforced by fixed splinting appliances. Observations made over many years have led to the conclusion that partial dentures seldom are constructed poorly or fail structurally. The most frequent cause of failure of partial dentures is the loss of abutment teeth because some of the afore-mentioned principles relating to the preparation of the mouth prior to construction have been ignored.

SELECTIVE GRINDING

Selective grinding of teeth to establish balanced occlusion has occupied an important place in dentistry for many years. Schuyler[1] and McLean[2] have emphasized the necessity of balanced occlusion not only in the natural dentition, but in

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2. McLean, D. W. Pathologic occlusion: a major clinical problem. J.A.D.A. 31:1586 (Dec. 1) 1944.

artificial teeth as well. Brown[3] and Westbrook[4] have described balanced patterns of opposing tooth contact in centric closure of the mandible from which efficient excursive movements can be easily established. The objective of the dentist, then, should be to eliminate interference in centric and eccentric movements of the mandible, to establish reciprocal balancing contacts between opposing teeth and to improve the working and balancing bite. The operator must remember at all times that the mandible and mandibular teeth are essentially one and the same object and normally the movement of one is impossible without the movement of the other. In the attainment of occlusal equilibration, disharmony is eliminated not only between opposing teeth but between the mandible and skull.

Radiating temporal pains, obscure headaches, temporomandibular tenderness, and tenseness of facial muscles are at times caused by abnormal mandible displacements resulting from cuspal and inclined plane disharmonies of the opposing teeth. This pressure is often reflected in the periodontal tissues.

Fig. 1 • Mandible describes a perfect arc from physiologic rest position to complete closure provided no centric interference exists

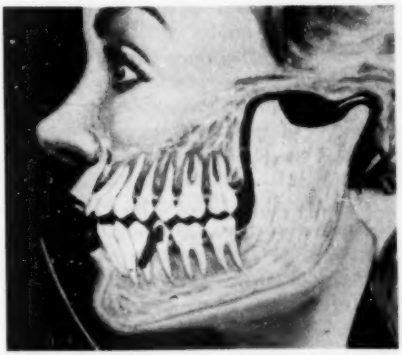

Fig. 2 • Arc described by mandible from physiologic rest to first premature centric contact is unbroken. Arrow shows first precentric contact on second bicuspids

In closure of the mandible between physiologic rest position and first contact of the mandibular and maxillary teeth, an imaginary hinge axis exists in the condyle. At the same time, the mandible swings in a perfect arc. This remains unbroken to complete closure of the jaw, provided no premature centric contact exists (Fig. 1). If, however, one does exist, the arc remains unbroken to the point of first precentric contact (Fig. 2). At this point, cusps and inclined planes are engaged between mandibular and maxillary teeth, and the mandible is forced forward laterally, or forward and laterally on further closure. This breaks the continuity of the arc sharply, forcing it usually into a more forward position. At the same time the condyle is displaced, and if the forward displacement is severe, a forward and downward path is assumed by it (Fig. 3). Precentric contact is usually attended by resultant facial

3. Brown, S. W. Disharmony between centric relation and centric occlusion as a factor in producing improper tooth wear and trauma. D. Digest 52:434 (Aug.) 1946.

4. Westbrook, J. C., Jr. A pattern of centric occlusion. J.A.D.A. 39:407 (Oct.) 1949.

muscle imbalance, injury to the tooth structure, periodontal structures, or condylar anatomy, or any combination of these. Without first eliminating this abnormal jaw relationship by corrective grinding, proper restoration by partial dentures would be increasingly difficult. Certainly it would accelerate the loss of the remaining natural teeth, or force the task of occlusal equilibration on the operator after the appliance is inserted, a procedure which frequently proves unsatisfactory.

SYSTEMIC AND LOCAL CAUSES OF PERIODONTAL INVOLVEMENT

Careful roentgenographic interpretation of the supporting bone, coupled with knowledge of the degree of tooth mobility, can often be the determining factor in deciding whether or not some systemic manifestation plays a major role in periodontal involvement. Systemic causes should be strongly suspected if the periodontal bone loss is generalized and of a horizontal pattern, with considerable tooth movement. On the other hand, if only isolated teeth show mobility, or if the mobility is in proportion to the existing bone loss, which is not uniform and presents a sharp demarcation roentgenographically between normal and involved areas, major local causes can be suspected.

Fig. 3 • Shows sharp break in arc on complete closure from premature centric contact. Note forward displacement of condyle

Food packs can, and often do, exist between teeth with normal contacts. Wedging cusps on the opposing teeth act to spread these contacts on biting, plunge food between them, and then allow them to close when pressure is released. This type of food impaction is eliminated on proper occlusal balancing, and allows the usual accompanying vertical periodontal pocket a chance of recovery. It is evident that food packs caused by lost contacts, or by poor tooth or restorative anatomy, must be corrected by proper restorative measures or by orthodontic means.

FIXED SPLINTING

The old concept that each tooth should be allowed its individual movement to maintain health seems to have been disproved by the present accepted practice of splinting groups of teeth with continuous inlays, three-quarter crowns, full crowns, or a combination of these. It is now known that the life expectancy of periodontally weakened teeth treated in this fashion is greatly lengthened. Frequently teeth that would be condemned because of supporting bone loss and their position in the arch can be retained indefinitely and in good health, and even used as abutment teeth for fixed or removable appliances with perfect comfort and stability if properly stabilized by fixed splinting. The value of this to the patient is evident and emphasizes the importance of careful and over-all treatment planning in each case.

Continuous fixed splinting is not limited to two or three teeth. Six weakened lower anterior teeth offer an ideal group to so stabilize, and by this procedure, the design of a lower partial denture can often be altered to improve

function, comfort, and to lessen bulk. Not only are the periodontally weakened teeth retained by this procedure, but the patient experiences greater comfort and a healthy condition is maintained for a longer period of time.

Some prosthodontists believe that splinting of weak abutment teeth for fixed restorations is unnecessary, and that a properly designed partial denture should itself act as a splint. However, a partial denture *per se* cannot substitute for fixed splinting of periodontally weakened abutment teeth.

MOUTH HABITS AS ETIOLOGIC FACTORS

It has been stated with regard to periodontal involvement[5] that "mouth habits are etiological factors all too frequently overlooked and their oversight is too often the cause of failure in otherwise sound treatment." Thirty-six vicious mouth habits have been listed by Sorrin.[6] To these can be added many more, and unfortunately, all are detrimental to periodontal health.

The diagnosing of mouth habits is made more difficult by the patient's seeming lack of cooperation. This apparent disinterest is not willful but is caused by a complete unconsciousness of the existing habit. Much can be learned by closely observing the patient in conversation, as a habit seldom exists without frequent repetition of it by an individual.

The habit of teeth rocking, bruxism or clenching of the teeth is usually accompanied by precentric contact of the teeth. Whether abnormal centric occlusion is responsible for mouth habits, or whether abnormal manipulation of the teeth encourages malocclusion, is a strictly academic question. The fact remains that in most instances the habits are lessened or completely eliminated after meticulous occlusal adjustment, and are usually difficult or impossible to correct until normal occlusal contact is restored.

MALNUTRITION

Malnutrition frequently is responsible for difficulties in diagnosis, improper treatment planning and causes a poor prognosis in periodontal complications. A simple analysis of the diet of patients will show that protein-carbohydrate imbalance and mineral and vitamin deficiencies are daily becoming more of a problem. These problems are complicated by the increased refinement of foods and national advertising campaigns to promote these so-called "foods." Price[7] has recorded general and periodontal degeneration in native tribesmen that were subjected to "civilized" diets, in direct contrast to fellow tribesmen living uncontaminated in their native habitat. Unfortunately, this physical degeneration is not confined to any locale, nor are the symptoms diagnostic in every case. Mann and co-workers,[8] Radusch,[9] Howe,[10] James,[11] and others have made exhaustive studies of certain nutritive factors and their direct effect on human dental structures. Orban and co-workers,[12] Topping and Fraser,[13] and others have demonstrated histopathologic changes in the oral tissues caused by vitamin starvation.

5. McKenzie, J. S. Teeth-rocking and teeth-clenching: an important factor in periodontal diseases. J. Florida D.A. 19:9 (Sept.) 1948.

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8. Mann, A. W.; Spies, T. D., and Springer, M. The oral manifestations of vitamin B complex deficiencies. Abst. J.D. Res. 20:269 (June) 1941.

9. Radusch, D. F. Nutrition and dental health. VII. Mineral availability and utilization—summary of dietary needs and recommendations. J. Periodont. 17:125 (July) 1946.

10. Howe, P. R. Further studies on the effects of diets upon the teeth and jaws. J.A.D.A. 9:55 (Jan.) 1922; 10:201 (March) 1923.

11. James, Allison G. Nutrition and dental disease. Ann. West. Med. & Surg. 1:277 (Sept.) 1947.

12. Orban, B.; Martin, W. B., and Hehn, R. M. Histopathological investigation of a case of scorbutic gingivitis. J. Periodont. 18:95 (July) 1947.

13. Topping, N. H., and Fraser, H. F.: Mouth lesions associated with dietary deficiencies in monkeys. Pub. Health S. R. 54:416 (March 17) 1939.

Protein is essential for building new tissue cells. Since this rebuilding process is necessary in all tissues of the body at all times for health, the need for an adequate amount of protein is apparent. The periodontal structures are no exception.

ADDITIONAL PERIODONTAL FACTORS

Diabetes,[14-16] blood dyscrasias,[17-19] and hormonal disturbances,[20-22] are additional systemic conditions which manifest themselves in the gingiva by changes in the color, shape and texture. Any inflammatory process in the oral cavity in which local causative factors are not readily apparent is an indication that further systemic studies should be made before any treatment is planned.

It has been repeatedly taught that periodontal pockets should be treated by subgingival curettage if the pockets are under 4 mm. in depth, and by tissue reduction—that is, gingivectomy, pressure packs or electro-surgery—if the pockets are deeper than 4 mm. I believe that this reasoning is unsound, and each periodontal case should be handled individually, taking into consideration the patient's age, the inflammation present in the tissues, the amount of hypertrophy existing, mouth hygiene and expected cooperation of the patient after treatment as well as the general health of the patient. In some cases it is reasonable to expect satisfactory results from curettage, whereas in others the prognosis would be poor even with the same treatment as, for example, when less of the periodontium is involved. An abnormal crevice depth after periodontal treatment by any method is potentially more harmful than a clean excision with no subsequent abnormal crevice. Periodontal health is imperative, not only when a prosthesis is involved, but in every case, and should be so treated that future relapse is minimized.

SUMMARY

Evaluation and treatment of the partially edentulous mouth should be made from a periodontal viewpoint before a partial denture is constructed. Consideration must be given to weak abutment teeth, the patient's general physical condition, spacing of the remaining natural teeth, existing mouth habits, traumatic occlusion, food packs, degree and type of periodontal destruction and prognosis. Completion of periodontal treatment before construction of a removable prosthesis insures better adaptation of the periodontal tissues, better prognosis because of less likelihood of soft tissue change, and better general health of the patient.

641 duPont Building

14. Glickman, I. Relation of experimental diabetes to periodontal disease. Am. J. Orthodont. & Oral Surg. (Oral Surg. Sect.) 33:703 (Oct.) 1947.

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Epidemiology of gingivitis in children

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The prevalence of gingivitis was studied in three large groups of children according to the method outlined by Schour and Massler[1] (1948), Massler and Schour[2] (1949) and by Massler, Schour and Chopra[3] (1950). This method is termed the PMA index and is designed to assess the amount of gingivitis present in large groups by determining the average number of papillary (P), marginal (M) and attached (A) gingival units affected per individual.

The three groups examined consisted of 8,882 white children living in suburbs near the City of Chicago and 17,079 white children plus 6,975 negro children living in the City of Philadelphia. The ages ranged from 6 to 17 years.

The examinations were made by 50 dentists under the supervision of the authors, and in Philadelphia, with the help of Albert Donzanti.

GINGIVITIS IN PHILADELPHIA AND SUBURBAN CHICAGO CHILDREN

The percentage of children in Philadelphia and in suburban Chicago who were affected by gingivitis and the average number of inflamed gingival units present in each group at each age level are shown in Table 1 and Figure 1. In both groups of children, the number of gingival units affected increased from 6 to 11 years of age with slight acceleration from 7 to 8 years (during the period of the eruption of the incisor teeth) and from 10 to 11 years of age (during the period of the eruption of the bicuspid and cuspid teeth). Gingivitis decreased after 11 years of age in both groups to a common plateau of about five PMA units affected after 16 years. The number of children affected followed a similar trend (Fig. 1).

Comparison of the data obtained from both cities revealed the fact that there was significantly less gingivitis in the Philadelphia school children than in the Chicago children (Fig. 1). The explanation for this difference might be the fact that an intensive program of oral hygiene was carried out in the Philadelphia schools during the past four years. Sixty-five per cent of the school children in the City of Philadelphia received prophylaxes at the time of the biennial examination. All the children received thorough

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3. Massler, M.; Schour, I., and Chopra, S. Occurrence of gingivitis in suburban Chicago school children. J. Periodont. 21:146 (July) 1950.

Table 1 • Gingivitis in Philadelphia and Chicago school children

Age in yrs.	Six Chicago suburbs						Philadelphia						Critical ratio
	No. examined	% Affected	Aver. no. ging. units affected per person examined				No. examined	% Affected	Aver. no. ging. units affected per person examined				
			P	M	A	PMA			P	M	A	PMA	
6	380	56	2.0	1.6	0.0	3.8	2,267	35	1.4	0.4	0.0	1.8	7.8
7	287	75	3.9	3.1	0.0	7.0	462	40	1.8	0.5	0.0	2.3	9.3
8	320	78	4.8	3.3	0.0	8.1	2,140	52	2.6	1.0	0.0	3.7	8.7
9	283	80	4.9	3.3	0.1	8.3	498	55	3.2	1.1	0.0	4.3	7.0
10	302	83	5.1	3.4	0.1	8.6	1,695	59	3.3	1.2	0.0	4.6	7.9
11	292	80	5.5	3.8	0.1	9.4	503	61	3.8	1.5	0.0	5.3	5.5
12	326	72	4.9	3.2	0.0	8.1	1,527	60	3.5	1.5	0.0	5.0	4.0
13	426	67	4.2	3.0	0.0	7.2	764	59	3.4	1.5	0.0	4.9	2.7
14	1,503	55	3.4	2.6	0.0	6.0	2,158	55	3.4	1.5	0.0	4.9	0
15	1,719	51	3.1	2.4	0.0	5.5	1,186	55	3.6	1.4	0.0	5.0	—2.1
16	1,550	48	3.0	2.0	0.0	5.0	2,967	58	3.7	1.4	0.0	5.1	—6.4
17	1,494	46	3.0	2.0	0.0	5.0	912	59	3.8	1.3	0.0	5.1	—6.2
Total	8,882						17,079						

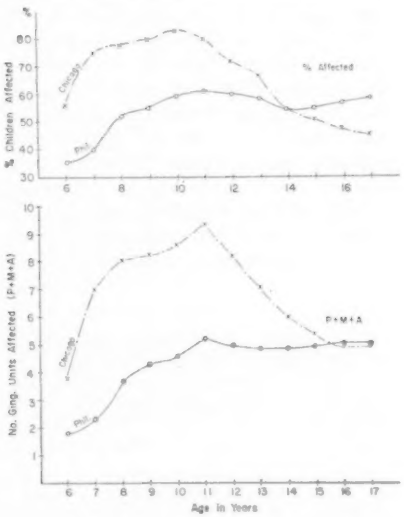

Fig. 1 • Gingivitis experience of children living in Philadelphia and in Chicago suburbs

instruction and practice in the technic of toothbrushing. The Chicago suburban schools did not have any similar program. The socioeconomic and nutritional conditions as well as the technic of examination were similar in both areas and could not account for the difference. It is interesting and significant to note that the caries experience was similar in both areas.

RACIAL DIFFERENCES IN GINGIVITIS EXPERIENCE

A comparison was made between the gingivitis experience of the 17,079 white and 6,975 negro school children living in the City of Philadelphia.

Table 2 and Figure 2 show that the number of gingival units affected by inflammation was significantly higher in

Table 2 • Gingivitis in white and negro children in Philadelphia

Age in yrs.	White						Negro					
	No. examined	% Affected	Aver. no. ging. units affected per person examined				No. examined	% Affected	Aver. no. ging. units affected per person examined			
			P	M	A	PMA			P	M	A	PMA
6	2,267	35	1.4	0.4	0.0	1.8	946	40	2.0	1.9	0.1	4.0
7	462	40	1.8	0.5	0.0	2.3	236	43	2.4	2.0	0.1	4.5
8	2,140	52	2.6	1.0	0.0	3.7	769	50	3.0	2.8	0.1	6.0
9	498	55	3.2	1.1	0.0	4.3	341	52	3.3	2.9	0.1	6.3
10	1,695	59	3.3	1.2	0.0	4.6	701	52	3.2	2.8	0.1	6.1
11	503	61	3.8	1.5	0.0	5.3	294	51	3.6	1.9	0.1	5.5
12	1,527	60	3.5	1.5	0.0	5.0	711	47	3.5	1.6	0.0	5.1
13	764	59	3.4	1.5	0.0	4.9	454	45	3.5	2.0	0.0	5.5
14	2,158	55	3.4	1.5	0.0	4.9	1,007	43	3.4	1.1	0.0	4.5
15	1,186	55	3.6	1.4	0.0	5.0	562	45	3.3	1.2	0.0	4.5
16	2,967	58	3.7	1.4	0.0	5.1	648	49	3.6	1.6	0.1	5.3
17	912	59	3.8	1.3	0.0	5.1	306	50	3.7	1.7	0.1	5.5
6-17	17,079						6,975					

the negro children from 6 to 11 years of age but that there was no significant difference between the two groups thereafter. There was no great difference in the percentage of negro and white children affected by gingivitis during the period from 6 to 10 years of age. A slightly greater number (9 to 14 per cent) of white children were affected after the age of 10 years. This difference was statistically significant, the critical ratio being 3.2 to 6.3.

Further analysis showed that the number of papillae affected at each age level was almost identical in the two groups (Fig. 2). However, the negro children had a greater number of marginal gingivae (and attached gingivae) affected from 6 to 11 years of age (Fig. 2). This implied that the severity and the extent of the inflammations were significantly greater

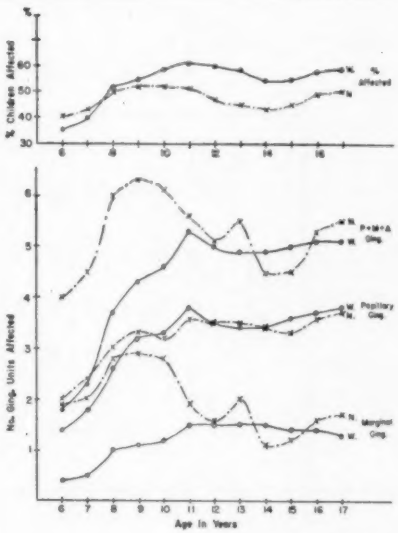

Fig. 2 • Gingivitis experience in white (o) and negro (x) children.

Table 3 • Sex differences in gingivitis experience of children

Age in yrs.	Chicago children (white)						Philadelphia children (white)						Philadelphia children (negro)					
	No. examined		% Affected		Average PMA		No. examined		% Affected		Average PMA		No. examined		% Affected		Average PMA	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
6	201	179	56	56	4.0	3.6	1,101	1,166	34	36	1.7	1.9	471	475	40	40	4.0	4.0
7	143	144	75	75	7.2	6.8	236	226	39	41	1.9	2.6	123	113	40	47	4.3	4.7
8	167	153	78	78	7.8	8.4	1,069	1,071	51	53	3.5	3.9	378	391	50	50	6.4	5.7
9	141	142	80	80	8.5	8.1	251	247	54	56	4.3	4.3	164	177	48	54	6.6	6.1
10	162	140	84	82	9.2	8.0	875	820	59	59	4.5	4.7	310	391	55	49	6.3	5.9
11	155	137	81	79	8.8	10.0	252	251	64	57	5.7	4.9	160	134	58	43	6.6	4.6
12	186	140	74	70	8.4	7.8	789	738	62	58	5.0	5.0	338	373	50	44	5.6	4.6
13	209	201	77	57	10.0	5.4	395	369	60	58	4.9	4.9	210	244	47	43	5.5	5.5
14	441	501	57	52	7.0	5.0	1,063	1,095	57	53	5.5	4.3	423	584	45	41	5.0	4.0
15	435	442	54	48	5.5	5.5	575	611	56	54	5.7	4.3	278	284	46	44	5.2	3.8
16	399	411	49	47	5.5	4.5	1,458	1,509	60	56	5.7	4.5	274	374	54	44	6.3	4.3
17	370	378	46	46	5.0	5.0	518	394	60	58	5.3	4.9	144	162	60	40	6.5	4.5
Total	3,009	2,968					8,582	8,497					3,273	3,702				
Total	5,977						17,079						6,975					

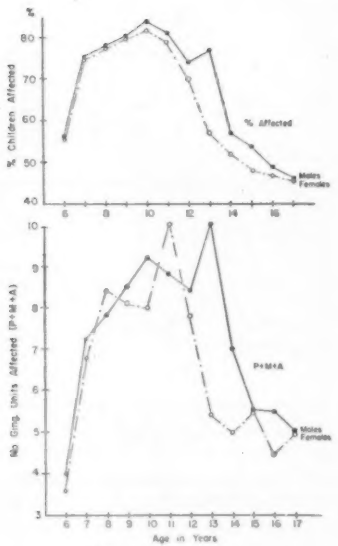

Fig. 3 • Gingivitis experience of white boys and girls in Chicago

in the negro children from 6 to 11 years of age, since inflammation generally spreads from the papillae to the margins if the papillary gingivitis is severe. A careful review of the individual records confirmed the fact that although the percentage of children affected in each group was not significantly different between 6 to 10 years of age, the papillary gingivitis in the negro children was more severe and often extended into the marginal gingivae and sometimes into the attached gingivae. White children showed only mild papillary gingivitis which was seldom severe enough to extend into the marginal gingivae.

When negro boys were compared with white boys, and negro girls compared with white girls, the racial differences from 6 to 11 years were even more striking while the similarities in the two groups between 12 to 17 years were more apparent.

The cause of the differences in the severity and extent of the gingivitis in the negro and white children is not clear. The negro children came from families in the lower economic and nutritional levels. It is possible that such factors might explain these differences. However, it should be pointed out that a much greater difference in gingivitis experience existed between white children living in Chicago suburbs and white children living in Philadelphia where the economic and nutritional levels were approximately the same.

SEX DIFFERENCES IN GINGIVITIS EXPERIENCE

Sex differences in the extent and amount of gingivitis were studied in the three groups of children separately since dif-

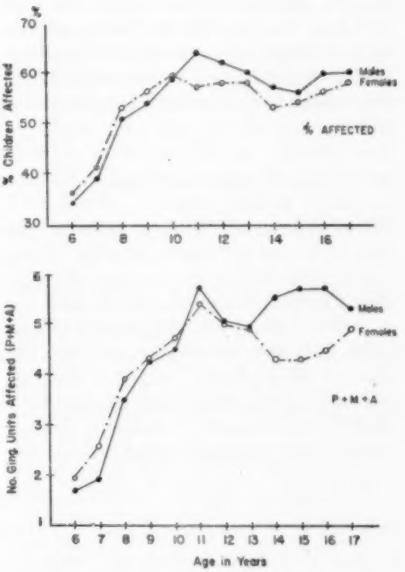

Fig. 4 • Gingivitis experience of white boys and girls in Philadelphia

ferences in gingivitis among the groups have been shown to exist (Table 3).

No differences were observed between boys and girls from 6 to 10 years of age in any of the three groups, in either the number of children affected or in the average number of gingival units affected. After 10 years of age (to 17 years of age) there was a consistent trend for fewer girls to be affected as shown in Table 3 and Figures 3, 4 and 5. However, this difference (2 to 10 per cent) was found to be statistically not significant. The critical ratio between the percentage of children affected was consistently below 2.0 and exceeded this figure only once in each group.

In the period from 13 to 17 years of age there was a tendency for girls to have, on the average, a lesser number of gingival units affected as shown in Table 3 and Figures 3, 4 and 5. This difference appeared at an earlier age and was more pronounced in the negro children. However, this difference between girls and boys was on the borderline of statistical significance for all three groups taken individually or in combination, and could not therefore be considered conclusive.

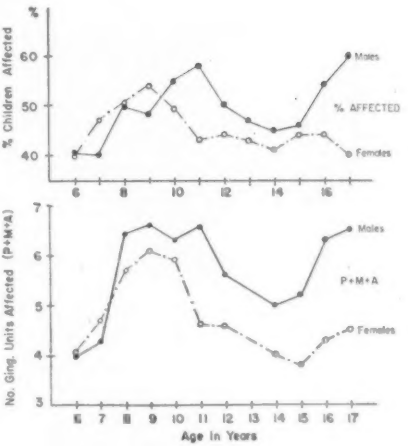

Fig. 5 • Gingivitis experience of negro boys and girls in Philadelphia

SUMMARY AND CONCLUSIONS

Three groups of children between the ages of 6 and 17 years, totaling 32,936 were examined for the presence of gingivitis. The percentage of children affected in each age group and the amount of gingivitis present as determined by the number of papillary, marginal and attached gingival units affected per child (PMA index) were recorded. Differences in the gingivitis experience of the groups with regard to city, race, and sex were calculated. The following general conclusions were arrived at:

1. The white children of Philadelphia had a lower incidence of gingivitis than the white children of suburban Chicago.

2. Negro children in the earlier age groups (6 to 11 years of age) had a higher incidence of gingivitis than the white children and a greater average severity of marginal gingivitis. There was no significant difference in gingivitis experience after the age of 12 years.

3. No significant differences between the gingivitis experience of boys and that of girls were demonstrable for any group from ages 6 to 12 years. There was a suggestion, however, that after the age of 13 years, girls experienced less gingivitis than did boys.

The organic compounds and enzymes of human saliva

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Of the body fluids, saliva is the one of most immediate interest to the dentist. It contains a multitude of constituents in its 0.3 to 0.7 per cent of solid matter. "Normal values" for the constituents have not yet been generally accepted, although many of the components have been claimed at various times to be useful as indicators of caries susceptibility.[1,2] Although the organic materials are the largest part of the total saliva solids (0.2 to 0.5 per cent) their composition is even less known than that of the inorganic portion. This paper will present a review of the knowledge of organic material of saliva without, however, going into the question of the relationship to dental caries and other oral diseases.

PROTEINS

The proteins of human saliva are the principal organic constituents but have not been characterized. The analyses available indicate that much of the protein may be in the form of a mucin. Human mucin has not received much attention, but cattle[3] mucin extracted from the submaxillary glands has been extensively investigated.

Total Protein · For the determination of total protein in human saliva, several procedures have been used. One involves precipitation with uranyl acetate and determination of the nitrogen content of the precipitate. Another utilizes the Greenberg procedure of determination of tyrosine and the calculation of total protein from the established tyrosine:protein ratio of 1:21.[4] Alcoholic precipitation also has been used.

Using the tyrosine ratio method, Karshan[5] reported the total proteins of activated saliva for over a hundred subjects to fall in the range 189 to 564 mg. per 100 cc., average 286 mg. Gorlin,[6] employing the same method on salivas of 35 subjects, reported similar values of 175 to 442 mg. per 100 cc., average 280

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†Public Health Service research fellow, National Institute of Dental Research.

1. Babkin, B. P. The physiology of the salivary glands. In Dental science and dental art, Gordon, S. M. Philadelphia, Lea & Febiger, 1938.

2. Karshan, M. The composition and calcium phosphorous metabolism of teeth. In Dental science and dental art, Gordon, S. M. Philadelphia, Lea & Febiger, 1938.

3. The source of these glands is not clear. Most authors refer primarily to glands obtained from the "slaughter-house." Several refer to oxen glands. It seems probable that the animals were cattle.

4. Krasnow, F., and Oblatt, E. B., Studies of variation in salivary proteins. (Abst.) J. D. Res. 13:239 (June) 1933.

5. Karshan, M. Factors in human saliva correlated with the presence and activity of dental caries. J. D. Res. 15:383 (Dec.) 1935.

6. Gorlin, R. J. Variations in salivary protein concentration. J. D. Res. 27:603 (Oct.) 1948.

mg. The alcohol precipitable protein of saliva was found by Lothrop and Gies[7] to fall in the range, 80 to 210 mg. per 100 cc., average 134 mg. This material had 18.7 per cent of ash.

Total nitrogen, apparently mostly protein nitrogen, varied between 29.5 and 75.0 mg. per 100 cc. for a group of 15 men.[8] For a similar group, Deakins and co-workers reported a range of total nitrogen of 36.1 to 125.3 mg. per 100 cc., and protein nitrogen (uranyl acetate precipitable nitrogen) as 22.9 to 88.2.

The necessity of taking definite precautions in collecting the saliva has been emphasized by Deakins. He found that the protein content of whole saliva decreased 42 per cent on standing for 24 hours at 30°C. and recommended that the saliva should be both collected and stored at 0°C. to eliminate enzyme and bacterial decomposition.[9,10]

The variation of protein concentration with rate of flow has also been studied. Tenenbaum and Karshan[11] found no significant difference between the protein concentration of stimulated and unstimulated saliva. Bramkamp[12] found little change in protein nitrogen concentration with change in rate of secretion for mixed saliva, but a considerable change was observed in the protein content of parotid saliva with change in secretory rate. Deakins and co-workers[10] found a significant difference in the protein content of mixed "slow" and "fast" flowing saliva.

Mucin • The major portion of the salivary proteins appear to be precipitated by slight acidification. A portion of this material may be a mucin which in terms of the implied definitions of early workers in this field is a material which is precipitated by slight acidification but which is soluble in strong acids (and weak bases). It is thought that the mucin is primarily responsible for the viscosity of saliva and that it is a secretion of the submaxillary and sublingual glands. Very little work has been done on human mucin.

Inouye[13] by a nephelometric method (using acid precipitation) obtained values for the mucin content of the saliva of about 30 "average" adult males. The range for paraffin stimulated saliva was 80 to 600 mg., average 270 mg. per 100 cc. The average for resting saliva was 250 mg. per 100 cc. Individual variations of the same order were found in both series.

In fresh saliva the mucin is said to be in the form of an alkaline salt, which may precipitate spontaneously or by the addition of acids. Gore[14] believes that the spontaneous precipitation may be a result of enzymatic action. The mucin, precipitating in the mouth, may be responsible for plaque formation. Gore reported the isoelectric point of his own mucin as at pH 4.70, whereas Inouye with 27 subjects found it to be 2.75 to 2.95. The latter value seems more likely to be correct.

Lothrop[15] prepared mucin from human saliva by two methods. Using acetic acid for precipitation, he obtained 1.5 Gm. of crude mucin from 10 liters of saliva. Six liters yielded only 0.47 Gm. of crude material when separated by ammonium sulfate precipitation. No analyses on the product were reported,

7. Lothrop, A. P., and Gies, W. J. A chemical study of saliva in its probable relation to the decay of teeth. J. Allied Dental Soc. 5:262 (Dec.) 1910.

8. Brown, J. B., and Klotz, N. J. Studies on the chemistry of mixed human saliva. I. J. D. Res. 14:435 (Dec.) 1934.

9. Deakins, M. Effect of storage temperature on the precipitable protein content and catalase activity of whole saliva. J. D. Res. 20:129 (April) 1941.

10. Deakins, M., and others. Significance of salivary analysis upon small groups of subjects. J. D. Res. 20:161 (June) 1941.

11. Tenenbaum, B., and Karshan, M. Factors in saliva correlated with the occurrence of calculus. J.A.D.A. 26:1965 (Dec.) 1939.

12. Bramkamp, R. G. The protein content of human parotid saliva. J. Biol. Chem. 114:369 (June) 1936.

13. Inouye, J. M. Biochemical studies of salivary mucin. J. D. Res. 10:7 (Feb.) 1930.

14. Gore, J. T. Saliva and enamel decalcification. V. Clinical interpretation. J. D. Res. 19:563 (Dec.) 1940.

15. Lothrop, A. P. A study of salivary mucin. J. Allied Dental Soc. 7:410 (Sept.) 1912.

and no other work has been done apparently on human salivary mucin.

In view of the general coincidence in the amounts of total protein and of acid-precipitable material in human saliva, most of the protein must be acid-precipitable. The proportion of actual mucin is uncertain. The problem of classifying proteins in mixtures of this type is extremely difficult, particularly in view of the empirical nature of protein classification. Mucin presumably is a "conjugated protein" containing combined carbohydrate and acid groups of unknown nature. It has been classified as a glycoprotein. Farroni[16] reported that saliva contains small amounts of albumins and globulins, similar in properties to serum albumins and globulins. Smaller quantities of peptone and nucleoprotein were also reported. Much more work is required, however, before the proteins accompanying the mucin can be properly classified.

Submaxillary Mucin of Animals • Much work has been done to determine the properties of mucin obtained by direct extraction of the submaxillary glands of cattle.[2] Because of the paucity of knowledge regarding human salivary mucin, this work with animal mucin will be considered.

Städeler (1859) extracted submaxillary glands with water and precipitated the mucin with acetic acid. This procedure was later followed by Obolensky (1871). Hammarsten[17] made a detailed study of preparatory methods, and this work is the basis for the methods commonly used. The minced gland was extracted with water; hydrochloric acid was added to the filtered extract until the precipitate which initially formed redissolved. The acid concentration was 0.1 to 0.2 per cent. The mucin was precipitated by dilution of the acid solution, and could be purified by repetition of this procedure. This method was said to produce mucin free of nucleoprotein which was a contaminant of the earlier preparations. This same general method has also been used by Tanabe to obtain the mucin from the sublingual gland. Inouye[18] obtained a yield of 4.8 to 7.9 Gm. per kilogram of submaxillary glands, but no mucin was obtained from nine pounds of parotid glands. Tanabe's yield was 17 Gm. per kilogram.

Hammarsten's classical investigations included a study of the properties and composition of the mucin. The elementary analysis of his material corrected for ash was: carbon, 48.84 per cent; hydrogen, 6.80 per cent; nitrogen, 12.32 per cent; sulfur, 0.84 per cent; oxygen, 31.20 per cent (by difference); the phosphorus content was insignificant; ash, 0.35 per cent. Lothrop[15] obtained similar values for nitrogen and sulfur. Gliadin of wheat according to Osborne's analysis has the following composition: carbon, 52.72 per cent; hydrogen, 6.86 per cent; nitrogen, 17.66 per cent; oxygen, 21.73 per cent; sulfur, 1.03 per cent. Mucin then has an appreciably lower carbon and nitrogen content than gliadin, and the difference is primarily made up by an increase in the amount of oxygen. The nitrogen content is significantly less than that of typical proteins[18] but is typical of mucins of different origins.[19,15] The sulfur content is primarily organic (possibly cysteine and methionine), since the hydrolyzable sulfate content is extremely small.[20]

The low carbon and nitrogen and high oxygen content of mucin indicates the presence of a carbohydrate component. Colorimetric procedures including the

16. Farroni, B. Detection of albuminous substance in saliva. Zentralbl. f. Biochem. u. Biophys. 15:221, 1913.

17. Hammarsten, O. Über das Mucin der Submaxillardrüse. Ztschr. f. physiol. Chem. 12:163, 1888.

18. Block, R. J. The amino acid composition of food proteins. In Advances in protein chemistry, vol. 2. Anson, M. L., and Edsall, J. T., editors, New York, Academic Press, 1945, p. 123.

19. Levene, P. A. T. Hexosamines and mucoproteins. London, Longmans Green & Co., 1925, p. 126.

20. Blix, G. Über die Kohlenhydratgruppen des Submaxillarischmucins. Ztschr. f. physiol. Chem. 240:43, 1936.

Sørensen and Haaguard method and the Ehrlich reagent have been used to investigate the nature of the combined carbohydrate. These identifications must be interpreted with caution until substantiated by further work. Blix[20] found a "mannose" content of 3.5 per cent and a glucosamine content of 9 to 11 per cent. Meyer[21] claimed that the carbohydrate portion consists of N-acetylglucosamine and gluconic acid. His material contained 18 to 22 per cent hexosamine and a peptide portion. He found only traces of sulfur. Tanabe[22,23] prepared both submaxillary and sublingual mucin by the same procedure. The mucins were found to be similar. The submaxillary mucin was said to contain 13 per cent glucosamine, 3.9 to 4.8 per cent glucuronic acid, 2.1 to 3.2 per cent combined hexose (mixture), and 6.6 to 7.0 per cent acetyl. The composition of the sublingual mucin was similar, but the hexose appeared to be galactose. Only the presence of glucosamine seems to be definitely established.

Submaxillary mucin has the following characteristics.[17,13] It is only slightly soluble in water, but is readily soluble in weak alkali or strong acid. A slight excess of alkali causes rapid destruction. Mucin solutions made with minimal amounts of alkali are stable. Mucin solutions are precipitated by acetic acid or by carefully controlled amounts of mineral acids; alcohol will also precipitate its salt from neutral solutions. According to Inouye, the salt is not precipitated by lead acetate or mercuric chloride. Hammarsten's preparations gave a positive xanthroproteic test (presence of the benzene ring). Adamkiewicz and Millon's tests indicated the presence of tryptophan and tyrosine respectively. Oldfeldt,[24] from titration curves, found the acid-combining power of mucin to be 3×10^{-4} moles hydrochloric acid per gram and the base-combining power to be 16×10^{-4} moles sodium hydroxide per gram. The isoelectric point in a citrate buffer was located at pH 2.5. Tanabe[22] reported the optical rotation as $[\alpha]_D = -21.4$; the reducing power to ferricyanide was determined as 10 per cent of the same weight of glucose.

Tanabe[23] found that sublingual mucin had the following characteristics. The biuret test for peptide linkages was positive. A positive Molisch test indicated the presence of a carbohydrate. The ninhydrin reaction indicated the presence of α-amino acids. Color reactions indicated the presence of tyrosine, arginine, and tryptophan.

Sputum Mucin • Müller[25] prepared mucin from sputum obtained from the respiratory apparatus of patients with chronic bronchitis, bronchial asthma and certain kinds of pneumonia. He prepared several kilograms of mucin by alcohol precipitation. Because of the nucleoproteins which were present, he extracted first with alcohol and then with an extremely dilute sodium carbonate solution. The product was further purified by solution in weak alkali and precipitation with acetic acid and alcohol.

The mucin obtained by this method was acidic. One of the preparations had the following average elementary analysis: carbon, 48.26 per cent; hydrogen, 6.91 per cent; nitrogen, 10.7 per cent; oxygen (calculated), 33.1 per cent; ash, 1.42 per cent; chlorine, traces; sulfur, 1.45 per cent. By acid hydrolysis 36.9 per cent reducing sugar was obtained. Acetic acid was identified as one of the products of hydrolysis by the analysis of its silver salt. Glucosamine was shown

21. Meyer, K. Mucoids and glycoproteins. In Advances in protein chemistry, vol. 2, Anson, M. L., and Edsall, J. T., editors. New York, Academic Press, p. 268.

22. Tanabe, Y. Biochemical studies on carbohydrate XLIX. Submaxillary mucin and mucoid. J. Biochem. (Japan) 30:181, 1939.

23. Tanabe, Y. Biochemical studies on carbohydrates. XXXVIII. Mucin from sublingual gland. J. Biochem. (Japan) 28:227, 1938.

24. Oldfeldt, Carl-Olof. Physikalisch-chemische Untersuchungen an einiger Mucinen und Mucoiden. Ztschr. f. physiol. Chem. 240:249, 1936.

25. Müller, F. Beiträge zur Kenntnis des Mucins und einige damit verwandter Eiweisstoffe. Ztschr. f. Biol. 42:468, 1901.

Table 1 • Total urea and ammonia nitrogen in human saliva

Investigator	Type of saliva	Urea + ammonia nitrogen (mg./100 cc.)	Urea nitrogen (mg./100 cc.)	Ammonia nitrogen (mg./100 cc.)
Hench and Aldrich[28]	Stimulated (?)	6.0–13.0	0.9–5.8	1.0–11.6
Wu and Wu[31]	Resting	7.4–18.6		
Updegraff and Lewis[27]	Stimulated	6.8–15.9 av. 11.3	0–4.7 av. 4.1	2.1–13.2, av. 5.7
Jacobson and Kesel[32]	Stimulated			av. 7.0–9.0
Stephan[33]	Resting		av. 20	
	Stimulated		av. 13	
Schlutz and Ziegler[34]	Resting	7.0–16.0		
Maupetit[35]	Stimulated (?)	13.0–21.0	6.0–11	5.0–11.0
Reported by Kesel[29,30]				1.5–17.0

definitely to be present by its isolation as the crystalline hydrochloride.

UREA AND AMMONIA

The urea and ammonia content of saliva is of special interest because of their possible inhibitory effects on certain oral microorganisms and on dental caries. In addition, medical research workers have attempted to correlate their concentration in saliva with their corresponding blood concentrations.

Urea seems to be a true salivary gland secretion, but the status of ammonia is in question. Ammonia was not found by Cary[26] in saliva which was collected directly from the glands without bacterial contamination. Updegraff and Lewis[27] and Hench and Aldrich[28] believed that the ammonia was derived largely from the bacterial (urease) decomposition of urea. Cary[26] found, however, that the urea content of incubated saliva was not sufficient to account for the amount of ammonia formed. Kesel and co-workers[29,30] noted an increase in the total titratable acidity of salivary cultures, which by formol titration was shown to arise by liberation of amino acids probably as a result of proteolysis. Kesel and co-workers[29,30] found that salivary microorganisms could liberate ammonia from amino acids.

Because of presumed secondary formation of ammonia from urea and other substances, it has become common to determine "total ammonia and urea" nitrogen by a single procedure. Wu and Wu[31] have provided a convenient micro method for this purpose. Some of the values obtained are given in Table 1.

In consideration of the probable secondary origin of ammonia, a direct relationship with blood urea and ammonia

26. Cary, J. E. The development of alkali within saliva and its relation to dental caries. Austral. J. Den. 50:4 (Jan.) 1946.

27. Updegraff, H., and Lewis, H. B. A quantitative study of some organic constituents of the saliva. J. Biol. Chem. 61:633 (Oct.) 1924.

28. Hench, P. S., and Aldrich, M. The concentration of urea in saliva. J.A.M.A. 79:1409 (Oct. 21) 1922.

29. Kesel, R. G., and others. The amino acids and their deaminating systems present in human saliva. Am. J. Orthodont. & Oral Surg. (Oral Surg. Sect.) 33:68 (Feb.) 1947.

30. Kesel, R. G., and others. Ammonia production in the oral cavity and the use of ammonium salts for the control of dental caries. Am. J. Orthodont. & Oral Surg. (Oral Surg. Sect.) 33:80 (Feb.) 1947.

31. Wu, Daisy Y., and Wu, H. Determination of urea in saliva. Proc. Soc. Exper. Biol. & Med. 76:130 (Jan.) 1951.

32. Jacobson, M., and Kesel, R. G. Salivary ammonia and its correlation to dental calculus. I. Ammonia nitrogen development from the supernatant liquid and the residue of centrifuged saliva during a nine-day incubation period. J. D. Res. 29:364 (June) 1950.

33. Stephan, R. M. The effect of urea in counteracting the influence of carbohydrates on the pH of dental plaques. J. D. Res. 22:63 (Feb.) 1943.

34. Schlutz, F. W., and Ziegler, M. R. A quantitative method for the determination of the combined urea and ammonia nitrogen of saliva. Am. J. Dis. Child. 31:520 (April) 1926.

35. Maupetit, J. Sur la teneur de la salive humaine en ammoniaque et en urée. Compt. rend. soc. de biol. 109:874 (March 23) 1932.

Table 2 • Amino acids in stimulated human saliva[39]

Amino acid	Concentration (mg./100 cc.)	Amino acid	Concentration (mg./100 cc.)
Tryptophan	0.12–0.9	Tyrosine	0.2–1.0
Arginine	3.3–10	Proline	0.35–1.5
Valine	0.7–2.2	Leucine	0.025–0.3
Glutamic acid	3.0–12.6	Serine	1.0–1.8
Phenylalanine	0.6–2.5	Isoleucine	0.2–0.9
Threonine	0.4–5.6	Cystine	0.16–0.45
Lysine	0.25–1.5	Histidine	0.35–2.0
Glycine	1.9-15.5	Methionine	<0.05

seems unlikely. The sum of urea and ammonia nitrogen is remarkably constant in healthy persons, however, and seems to parallel closely the corresponding blood value for urea.[27, 28, 33, 34] In cases of nephrosis and prostatic obstruction, the blood and saliva values may be much increased.

URIC ACID AND CREATININE

Picric acid gives a test with saliva which may be a result of the presence of creatinine.[36] Morris and Jersey[37] studied the continuous secretion of creatinine by one individual in resting saliva over a period of eight hours and reported that 0.13 to 0.18 mg. were secreted during each half hour. The variation in concentration was 0.58 to 1.09 mg. per 100 cc. The amount of uric acid secreted over 14 hours varied between 0.15 and 0.55 mg. each half hour with a concentration variation of 2.58 to 7.37 mg. per 100 cc. The test subject was on a low purine diet. Considerable variations in the urea and ammonia production in the same test subject were also noted. Kallós[38] found in 100 cases a variation of uric acid between 0.9 and 20.6 mg. per 100 cc., but considered that values above 4.0 mg. were abnormal. It was suggested that levels of uric acid in saliva have more general clinical significance than blood and urine values. Updegraff and Lewis's range was much less: 0.5 to 2.9 mg. per 100 cc. (72 subjects).[27]

AMINO ACIDS

The amount of free amino acids in saliva is so small that early workers were not able to measure them.[27] The sensitive method of microbiological analysis has shown that practically all of the natural amino acids are present as minor constituents. Kirch and co-workers[39] determined the ranges of concentration of amino acids in the stimulated saliva of 18 persons, including both caries active and inactive individuals (Table 2). Although the daily variation was great, the amino acids present in largest amounts were glutamic acid, glycine and arginine. Methionine, if present, was very small in amount.

General qualitative agreement with these results was reported by Goldberg, Gilda and Tishkoff.[40] Of the compounds listed in Table 2, no evidence was found in the three salivas analyzed for tryptophan, threonine, isoleucine or cystine. Serine and histidine were found in only one of the salivas. On the other hand, aspartic acid, alanine and methionine were additional components of all three. Taurine was qualitatively identified.

CARBOHYDRATE CONTENT

In view of the possible relationship between the fermentable sugars in saliva and the formation of organic acids by oral bacteria, the subject has considerable

36. Howe, P. R. The saliva. D. Cosmos 55:1112, 1913.
37. Morris, J. L., and Jersey, V. Chemical constituents of saliva as indices of glandular activity. J. Biol. Chem. 56:31, 1923.
38. Kallós, J. Uric acid in the saliva. (Abst.) Lancet 236 (1): 1226 (May) 1939.
39. Kirch, E. R., and others. Amino acids in human saliva. J. D. Res. 26:297 (Aug.) 1947.
40. Goldberg, H. J. V.; Gilda, J. E., and Tishkoff, G. H. Paper partition chromatography: free amino acids in saliva. J. D. Res. 27:493 (Aug.) 1948.

interest to the dental profession, but has not been well investigated. In addition to sugars derived from the salivary glands and from ingested foods, carbohydrate components are found in the mucins and blood-group substances discussed in other sections.

The amount of reducing sugar in saliva free from ingested sugars is much less than that in blood. Studies currently in progress by the authors of this review show that the carbohydrate of stimulated human saliva is composed of both bound and free reducing substances. A considerable portion of the free reducing substance is associated with the mucin. The actual values obtained depend greatly on the method used for protein removal. Precipitation of mucin by adjustment to the isoelectric point or by use of tungstic acid seems to give the best results for reducing sugar.

In consideration of the many influencing factors, Young[41] has suggested that little weight can be given to the earlier work which was principally qualitative in nature. Using the deproteinization method of Somogyi and a micromethod for reducing sugars, Young determined free-reducing substances in the deproteinized saliva of 15 individuals. Calculated as glucose, the ranges were 11.3 to 28.1 mg. per 100 cc. for resting saliva and 14.0 to 30.0 mg. per 100 cc. for stimulated saliva. Similar ranges of concentrations were found previously by Simon (1926) and by Luisada (1934). Volker and Pinkerton[42] reported values of 13 to 30 mg. per 100 cc., average 20 mg. for whole unstimulated saliva. Blatt, Kern and Kortuen[43] found a range of 7 to 27 mg. in whole unstimulated salivas of 30 fasting subjects, average 10.6 mg. per 100 cc.

After meals, the salivary reducing substances may increase to very high values, to as much as 4 to 6 per cent after ingestion of candies. The rate of sugar clearance depends on the type of food material, but the saliva usually returns to its normal sugar content in 30 to 120 minutes.[42, 44]

The relationship of blood and salivary glucose has not been settled. Blatt and co-workers[43] reported a direct proportionality but did not take oral clearance rate into consideration. Cohen[45] could not find an increase in the salivary reducing sugar of diabetics. For cats, at blood levels less than 400 mg. per 100 cc. no relation between blood and salivary (submaxillary) glucose could be demonstrated except when epinephrine was administered.[46]

PHOSPHOLIPIDS, ORGANIC PHOSPHORUS AND CHOLESTEROL

Krasnow,[47] using groups of 100 to 200 subjects, has attempted to establish "normal" levels of salivary cholesterol and lipid phosphorus. Although the cholesterol concentration varied in the range, 2.3 to 50 mg. per 100 cc., a normal average of 7.9 mg. was adopted. A difference between "acid" and "alkaline" saliva was noted, with acid saliva having an average of 13.5 to 15.7 mg. and with alkaline saliva having an average between 5.3 and 9.2 mg.

The alcohol-ether extractable "lipid phosphorus" was claimed by Krasnow[48] to lie "normally" in the range 0.02 to 0.24 mg. per 100 cc., average 0.119 mg. Sub-

41. Young, D. H. Past and present methods and results of sugar analysis of saliva. J. D. Res. 20:597 (Dec.) 1941.

42. Volker, J. F., and Pinkerton, D. M. Some observations on the clearance of glucose from the oral cavity. J. D. Res. 26:9 (Feb.) 1947.

43. Blatt, M. L.; Kern, M., and Kortuen, C. M. A quantitative study of saliva glucose. J. Pediat. 27:71 (July) 1945.

44. Teuscher, G. W. Sugar retention in the mouth. Northwestern U. Bull. 37:17, 1937.

45. Cohen, M. M. Clinical studies of dental caries susceptibility in young diabetics. J.A.D.A. 34:239 (Feb. 15) 1947.

46. Hebb, E. D., and Stavraky, G. W. The presence of glucose in the salivary secretion after the administration of adrenaline. Quart. J. Exper. Physiol. 26:141, 1937.

47. Krasnow, F., and Oblatt, E. B. Salivary cholesterol. J. D. Res. 16:151 (April) 1937.

48. Krasnow, F. Physiological significance of phospholipid in human saliva. J. D. Res. 24:319 (Dec.) 1945.

Table 3 • Vitamins in human saliva[53]

Vitamin	Micrograms per 100 cc.
Thiamin-HCl	0.7
Riboflavin	5.0
Nicotinic acid	3.0
Pyridoxin-HCl	60.0
Pantothenic acid (calcium salt)	8.0
Folic acid	0.01
Biotin	0.08
Vitamin C (Stimulated saliva	170.0
Vitamin C (Unstimulated saliva	240.0
Vitamin K (as menadione)	1.5

clinical disease conditions or malfunctions were claimed to result in a definite increase. For 200 subjects the average was 0.24 with a spread between 0.02 and 1.79 mg. per 100 cc. Previously, Youngburg (1932) and Mathis (1934) had not found any phospholipids in saliva. Weber (1930), however, had found extremely high values, 8.5 to 14.0 mg. per 100 cc.[49]

Phosphorus exists in saliva as inorganic and organically combined phosphate. The determination of the distribution of phosphorus between the various fractions is difficult. Becks[49] has discussed the problems involved and has summarized the earlier results. Eggers Lura[50] more recently has reported the total organic phosphorus of 50 subjects to be in the range 0.9 to 14.6 mg. per 100 cc., with a mean of 5.5 mg. On the average, 20 to 25 per cent of the total phosphorus was organically combined.

BLOOD-GROUP SUBSTANCES

Many humans have the substances which characterize their blood types as constituents of their salivas. From the saliva of these "secretors" the corresponding blood group A, B, and O substances of polysaccharide nature have been isolated in yields of about 1.5 mg. per 100 cc. It is interesting that some persons are "non-secretors."[51] Some of these individuals at least have a material in saliva much like the group specific substances but without their isoagglutination characteristics.[52]

VITAMINS

The presence of vitamins in saliva may be important in indicating the nutritional status of the individual and in the establishment of the oral flora. The amounts present are small and the difficulties of analysis manifold, but the recent development of specific methods has made it possible to determine some of the major vitamin constituents. In common with the enzyme content of saliva (considered later), the possibility that the vitamins are derived from the oral microflora must be considered.

The average concentrations in resting saliva of vitamins, particularly of the B-group, are given in Table 3. Only a small number of samples were involved in this work (8 persons). Microbiologic tests were used for the B vitamins. Vitamin C was determined with 2,4-dinitrophenylhydrazine, and vitamin K by the chick test.[53] Similar values for ascorbic acid (250) and for pantothenic acid (1.2 to 19) were reported previously.[54, 55] Cooper[56] in rat feeding experiments was not able to demonstrate any vitamin A in saliva.

49. Becks, H. Human saliva. IV. Critical discussion of former studies of the distribution of salivary phosphorus fractions. J. D. Res. 17:217 (June) 1938.

50. Eggers Lura, H. Investigations on the salivary phosphates and phosphatases. J. D. Res. 26:203 (June) 1947.

51. Landsteiner, K., and Harte, R. A. Group-specific substances in human saliva. J. Biol. Chem. 140:673 (Aug.) 1941.

52. Harte, R. A. Substances in human saliva from "non-secretors." J. Biol. Chem. 167:873 (March) 1947.

53. Glavind, J., and others. The presence of vitamins in the saliva. Internat. Ztschr. Vitaminforsch. 20:234, 1948.

54. Stuteville, O. H. Presence of vitamin C in saliva. Proc. Soc. Exper. Biol. & Med. 32:1454 (June) 1935.

55. Kniesner, A. H.; Mann, A. W., and Spies, T. D. Relationship of dental caries to deficiencies of the vitamin B group. J. D. Res. 21:259 (June) 1942.

56. Cooper, Ethel. The distribution of vitamin A in the urine and digestive secretions (man, dog). (Abst.) Am. J. Physiol. 63:425, 1923.

ENZYMES

Numerous enzymes have been reported as present in saliva. These include amylase, lipase, invertase, maltase, phosphatase, proteolytic enzymes, carbonic anhydrase, oxidases, urease, lysozyme and hyaluronidase. The amylase has been definitely established as a true product of the salvary glands; the lipase also seems to be a primary constituent. The action of the other enzymes is comparatively weak and in general their origin is questionable. Considerable evidence exists that they may be extracellular enzymes from the oral flora or that they are associated with the cellular components of sloughed-off oral tissues. In several instances, a parallelism between salivary (parotid) and pancreatic enzymes has been demonstrated. Thus, the amylases and proteases of these secretions are similar. Cohen[48] has summarized other evidence for a parotid-pancreas relationship.

Undoubtedly one of the principal biologic functions of saliva is as a protective and cleansing agent for the oral cavity. The enzyme components may be extremely important in degrading solid attached materials to a soluble stage so that they can be removed from the oral cavity. The enzymes, however, particularly the amylase, probably are rapidly inactivated in the stomach and it is unlikely that they have any significant role in the main digestive process.

Amylase[57] • The enzyme of saliva which degrades starches was one of the first enzymes discovered (Leuchs, 1831). It was called "ptyaline" by Berzelius, and apparently is secreted mainly by the parotid glands (Pavlov). Much work has been done with salivary amylase, and the enzyme was crystallized in 1947.[58]

The crystalline enzyme is a typical electrophoretically homogeneous protein with 15.8 per cent nitrogen, but with a rather small molecular weight of less than 45,000. At pH 8.5 (ammonia) the solubility in water was only about 0.3 per cent. In the original saliva, the salivary amylase was in the fraction not precipitated at pH 6.3 with 48 per cent acetone but precipitated by 70 per cent acetone.

Crystalline salivary amylase exhibits its optimal activity to starch at pH 6.9, but it acts over the range 3.8 to 9.4. It is active at the usual pH ranges of saliva. The presence of chlorides is required to prevent inactivation. It is rapidly inactivated below pH 4.8, and by the action of pepsin and trypsin.

Salivary amylase belongs to the group of α-amylases or liquefying amylases and resembles pancreatic amylase, especially. Other similar amylases are those of malt (and grains), *Bacillus subtilis* and Taka-diastase (from the mold *Aspergillus oryzae*). These enzymes are characterized by their rapid liquefaction of starch gels with the loss of materials giving the typical blue-red color with iodine and with the production of some reducing sugars.

When acting on starch components (amylose and amylopectin), the large molecules, containing several hundred to several thousand glucose units, are quickly broken down into short dextrins containing 6 to 8 glucose units. Subsequently, those dextrins are slowly hydrolyzed to give monosaccharides, disaccharides and trisaccharides.

Starch substances (amylose, amylopectin, glycogen)
↓ (rapid)
Dextrins (hexasaccharides, heptasaccharides and octasaccharides)
↓ (slow)
Glucose + maltose + maltotriose (+ isomaltose)

57. Myrbäck, K., and Neumüller, G. In the enzymes. Sumner, J. B., and Myrbäck, Karl, editors. New York, Academic Press, 1951. p. 683-686.

58. Meyer, K. H., and others. Sur les enzymes amylolytiques. Pt. X. Helv. Chim. Acta 31:2159; Pt. XI. 31:2165, 1948.

Despite the suggestion by Turner and Crowell,[59] there is no evidence for the existence in saliva of any amylase other than the α-amylase type.

Human salivas exhibit considerable variation in their amylase activity.[10,60,61,62] Infant saliva, even from premature infants, contains amylase, but the activity increases for about one year after birth.[62,63] Although individual variation is considerable, the maximum activity seems to be reached between 20 and 40 years. Subsequently there may be a gradual decrease in activity.[64] It is of interest that whereas the ape, guinea pig, squirrel, mouse and rat have considerable amylase in their saliva, the dog, sheep, cat, goat, horse and cattle appear to have salivas low or devoid of amylase activity.[65]

The most probable function of salivary amylase is as a cleansing agent for the oral cavity. A large part of the foodstuffs taken in by human beings is high in starch which in its cooked or pasted form clings to the oral tissues. The rapid liquefying action is favorable to the removal of the starches with their associated proteins and other food components. Some foodstuffs contain amylase inhibitors. Compounds containing the indole nucleus are effective amylase inhibitors in concentrations as little as 0.01 per cent.[66,67,68,69] As the inhibitors would lessen the formation of reducing sugars in the mouth, caries incidence might be reduced. The hexasaccharides and octasaccharides mainly formed initially are not readily fermentable by microorganisms, however, and the efficacy of amylase-inhibitors would probably depend on the proper balance of cleansing action and sugar formation.

Lipase • Human saliva contains a fat-hydrolyzing enzyme, a lipase. Using glycerol tributyrate at pH 7.6 as the substrate, Scheer[69] showed by surface tension measurements that saliva contains a lipase. The use of such a delicate method indicates that the action is not strong. Neutral fats are shown by titration methods to be split. The enzyme was much richer in parotid saliva than in saliva from the sublingual or submaxillary glands. No consistent variation of lipolytic activity as a function of age or disease condition could be demonstrated.[69,70] It is present in infant saliva at one month. Similar results were obtained with dog salivary lipase.[70,71] Peluffo[72] on the basis of inhibition experiments indicated that the salivary lipase is different from pancreatic lipase, and found that ultrafiltration did not lower the activity.

Proteolytic Enzymes • Saliva contains weakly active enzymes for the hydrolysis of proteins, particularly casein. According to Voss,[73] parotid saliva is richer in a trypsin-like enzyme than mixed saliva, and sublingual and submaxillary saliva is

59. Turner, N. C., and Crowell, G. E. Dental caries and tryptophane deficiency. J. D. Res. 26:99 (April) 1947.

60. Turner, N. C., and Crane, E. M. A relationship between dental caries and saliva. J. D. Res. 23:413 (Dec.) 1944.

61. Hubbell, R. B. The chemical composition of saliva and blood serum of children in relation to dental caries. Am. J. Physiol. 105:436 (Aug.) 1933.

62. Meyer, W. B. A comparison of the amylase concentration in the saliva of infants and adults. Bull. Johns Hopkins Hosp. 44:246, 1929.

63. Nicory, C. Salivary secretion in infants. Biochem. J. 16:387, 1922.

64. Meyer, J., and Necheles, H. Studies in old age; clinical significance of salivary, gastric and pancreatic secretion in aged. J.A.M.A. 115:2050 (Dec. 14) 1940.

65. Cohn, E. W., and Brookes, M. H. The diastatic activity of rat saliva. J. Biol. Chem. 114:139 (May) 1936.

66. Kneen, E., and Sandstedt, R. M. Distribution and general properties of an amylase inhibitor in cereals. Arch. Biochem. 9:235 (Feb.) 1946.

67. Miller, B. S., and Kneen, E. The amylase inhibitor of Leoti Sorghum. Arch. Biochem. 15:251 (Nov.) 1947.

68. Volker, J. F., and Murray, D. P. Salivary amylase inhibition. Tufts D. Outlook 21:3 (Sept.) 1947.

69. Scheer, K. Über lipase im Speichel. Klin. Wchnschr. 7:163 (Jan. 22) 1928.

70. Katzenstein, M. Untersuchungen über Speichellipase. Ztschr. f. d. ges. exper. Med. 69:179, 1929.

71. Koldajew, B., and Pikul. Über die lipolytische Wirkung des Speichels. Biochem. Ztschr. 212:53, 1929.

72. Peluffo, A. Action lipasique de la salive. Compt. rend. soc. de biol. 100:115 (Jan. 18) 1929.

73. Voss, Otto. Über eine trypsinartige Protease im Sekret der menschlichen Parotisdrüse Ztschr. f. physiol. Chem. 197:42, 1931.

devoid of activity. Voss provided evidence that this enzyme with an optimum pH at 8.0 was derived from the parotid gland. Earlier, however, Willstätter, Bamann and Rohdewald[74] concluded that although centrifuged saliva had some real proteolytic activity, the enzymes were probably derived from sloughed-off lymphocytes, leukocytes, epithelial cells and microorganisms.[75] In any case a considerable portion of the activity was associated with the cellular elements of whole saliva. They found that the protease resembled trypsin in its activity and that a peptidase was present.

Phosphatase • The presence of a phosphatase in saliva is interesting because of its possible effect on decalcification processes of the teeth and on calculus formation. Demuth (1925) claimed to have found phosphatase in saliva although his evidence was poor.[76] Eggers Lura[50] found that, as with blood, an alkaline and an acid phosphatase were present which hydrolyzed sodium glycerophosphate and disodium phenylphosphate. The optimal activity was at pH 5.5, but there was appreciable activity at 9.4. The phosphatases were found in parotid and submaxillary saliva, and were distributed in the sediment and supernatant after centrifugation. Fluorides were found to exhibit an inhibitory action, particularly on the acid phosphatase. Since the inorganic phosphorus of saliva initially decreased on standing whereas the organic phosphorus increased, an initial synthetic action of the phosphatase was suggested.

As with some of the other salivary constituents, the origin of the salivary phosphatase is in question. A number of investigators[77] have suggested that the oral soft tissue particularly when inflamed or traumatized liberates phosphatase (Adamson, 1929; Smith, 1930; Zander, 1941; Volloton, 1942). A portion of the phosphatase activity also may arise from oral microorganisms. *Penicillium spinulosum* (Thom), *Rhodotorula rubra* (Harrison), *Actinomyces buccalis* (Winslow), and *Actinomyces* (group I, Erikson), common in the mouth, were shown to produce extracellular phosphatase.[77] Glock and co-workers[77] and Dentay and Rae[76] found that the phosphatase activity of pooled saliva was inappreciable after filtration through a Seitz filter, and that centrifugation greatly reduced the activity of the supernatant. It would appear that the origin of the phosphatases is as yet unclarified.

Invertase and Maltase • When human saliva is incubated for one to two hours with sucrose, the reducing power is appreciably augmented, but the activity is much less than that of regular invertase preparations. The invertase seems to be derived from the oral microorganisms.[78,79] Volker[80] has shown that if 1 per cent sucrose is added to 10 cc. of fresh saliva, the reducing substance concentration increases from 15 mg. to 70 mg. within two minutes and remains at this level for at least 30 minutes.

Tauber and Kleiner,[81] however, claimed that saliva contains a maltase but no invertase. After incubation for 20 hours with saliva, maltose was hydrolyzed to the extent of 21 per cent. The maltase content of different individuals varied greatly.

74. Willstätter, R.; Bamann, E., and Rohdewald, M. Über die Enzyme der Speicheldrüse. Ztschr. f. physiol. Chem. 186:85, 1929.

75. Weinmann, J. Role of leucocytes in saliva (Abst.) J. D. Res. 15:360 (Sept.) 1936.

76. Dentay, J. T., and Rae, J. J. Phosphatase in saliva. J. D. Res. 28:68 (Feb.) 1949.

77. Glock, G. E.; Murray, M. M., and Pincus, P. The origin and significance of salivary phosphatase. Biochem. J. 32:2096 (Dec.) 1938.

78. Bourquelot, E. Sur l' invertine de la salive. Compt. rend. soc. de biol. 68:1096 (June) 1910.

79. Lisbonne, M. Sur l' invertine de la salive. Compt. rend. soc. de biol. 68:983 (June) 1910.

80. Volker, J. F. Some observations on the action of saliva on sucrose (Abst.) J. D. Res. 29:680 (Oct.) 1950.

81. Tauber, H., and Kleiner, I. S. The digestion and inactivation of maltase by trypsin and the specificity of maltases. J. Gen. Physiol. 16:767 (May) 1933.

Other Enzymes • The presence of a carbonic anhydrase, which catalyzes the liberation of carbon dioxide from carbonic acid, is important in considerations of the pH and buffering capacity of saliva and in calculus formation. Rapp[82] found that dialyzed saliva contains the enzyme, and that thiocyanates and sulfanilamide inhibit its action. Anderson[83] however, could not find evidence for this enzyme.

Oxidative enzymes may be present in whole saliva in small amounts.[84, 85] Possibly the activity arises from the leukocytes which have been shown to have some action. Catalase activity has been observed by Deakins,[9,10] and phenol oxidase activity by MacDonald and Smith.[84]

An enzyme which hydrolyzes urea to ammonia (and water) is a common and active constituent of saliva. Because of the possible role of ammonia in dentifrices, the presence of this enzyme is of particular importance. Jacobson and Kesel[32] showed that the salivary ammonia increased more than 300 per cent on three days' incubation. Stephan[86] and Cary[26] provided evidence that the enzyme is of bacterial origin, and may even be intercellular. Also much of the ammonia may come from amino acids or other compounds.

An active lysozyme preparation has been obtained from human saliva.[87] The active material was in the acetone precipitate and dissolved in 50 per cent alcohol containing 10 per cent acetic acid. From 3,900 cc. of saliva, 50 mg. of active dry product was obtained. The material was quite active against *Micrococcus lysodeikticus*. It was serologically distinct from egg white and cat-salivary lysozyme. Possibly this material is the same as that which has been isolated from sputum and nasal mucin.[88]

In 75 per cent of the 64 subjects tested, Lisanti[89] was able to demonstrate the presence of a hyaluronidase which caused a decrease in the viscosity of solutions of hyaluronic acid, but there was considerable variation in the activity of the individuals.

Apparently saliva contains an enzyme (mucinase) of bacterial origin.[90] The bound glucosamine and carbohydrate of saliva decrease on incubation, presumably because of enzymatic hydrolysis of the glycoproteins. The blood-type substances also decrease during incubation.

HORMONES

The presence of hormone-like materials in human saliva has been reported but has not been definitely established. Generally, hormones are defined as secretions of ductless glands. Whereas salivary glands have ducts opening into the oral cavity, apparently substances are secreted which are similar in action to hormones.

The effect of extirpation of the salivary glands of animals is controversial. Hemmeter (1907-1908) found that gastric secretion was decreased, but Loevenhardt and Hooker could not confirm these results. Keeton and Koch (1915) found that removal of the submaxillary glands had no effect. Swanson (1917) also found that complete removal of the

82. Rapp, G. W. The biochemistry of oral calculus. II. The presence of carbonic anhydrase in human saliva. J.A.D.A. 33:191 (Feb.) 1946.

83. Anderson, D. J. The hydrogen-ion concentration of the saliva. I. Factors influencing CO_2 content. J. D. Res. 28:72 (Feb.) 1949.

84. MacDonald, C. F., Jr., and Smith, H. C. Oxydase in saliva. J. Allied Dental Soc. 4:346 (Dec.) 1909.

85. Ville, M. J., and Mestreset, M. W. De l'origine buccale des oxydases, des peroxydase et des substances peroxylitiques de la salive mixte. Nimes, Assoc. franc. l'advancement sci., 1912, p. 261.

86. Stephan, R. M. Two factors of possible importance in relation to the etiology and treatment of dental caries and other dental diseases. Science 92:578 (Dec. 20) 1940.

87. Roberts, E. A. H.; Maegraith, B. G., and Florey, H. W. A comparison of lysozyme preparations from egg-white, cat and human saliva. Quart. J. Exper. Physiol. 27:381 (Feb.) 1938.

88. Fleming, A. On a remarkable bacteriolytic element found in tissues and secretions. Proc. Roy. Soc. (London). 93:306 (May 1) 1922.

89. Lisanti, V. F. Hyaluronidase activity in human saliva. J. D. Res. 29:392 (June) 1950.

90. Rogers, H. J. Bacterial hydrolysis and utilization of polysaccharide-like substances ("mucin") in saliva. Nature, London 161:815 (May 22) 1948.

salivary glands did not lower the gastric secretion. Bruno Farroni found that extracts of salivary glands had a marked glycolytic action in some types of experimental glycosurias.[91]

Higashijo[92] ligated the parotid glands of rats and removed the submaxillary glands. These and normal rats were injected with estrone. Distinct histologic changes in the hypophysis, parathyroids, thyroids and bones were found for the desalivated rats. The testes, thymus and spleen were atrophied and the suprarenal cortex and uterus were hypertrophied. The corpus luteum was atrophied in young rats which had only the submaxillary glands removed but which had hormone injections; the corpus luteum was not atrophied in the animals which had not received the hormone. These results seem to indicate a regulatory effect of the salivary glands on estrogens. Lacassagne[93] discovered sexual dimorphism in the mouse submaxillary gland, and reported that the submaxillary glands of female mice were changed into the male type by the administration of testosterone; estrone caused the reverse effect on male submaxillary glands. Further information has been provided by Ginn and Volker,[94] who studied the effect of complete removal of the salivary glands of albino rats. Much more pronounced effects were observed for the females than for the males; these results also suggest a possible relation between the salivary glands and the sex hormones. The observed effects were a reduction in the rate of growth and a rusting of the fur. A vitamin B complex deficiency also may have been involved since improvement of the condition was observed after the administration of pantothenic acid and choline. These vitamins did not, however, effect a complete cure.

Human saliva has been shown by Ternberg, Eakin and Dunlap[95] to contain apoerythein, the "intrinsic factor" of pernicious anemia. For 20 healthy persons the saliva was found to contain an average of 55.5 milliunits of apoerythein per cc. of saliva.[95] The values tended to decrease near meal time in a manner suggesting a limitation of the amount available for secretion. Beerstecher and Edmonds[96] found an anomalous behavior for this factor. All activity seemed to disappear from saliva heated to 70° C. for one minute or more, but no decrease in activity was produced in the case of samples heated at either lower or higher temperatures up to 100° C. for as long as five minutes. They offered no explanation for these results.

Ogata and his coworkers[97] claim to have found a hormone in human saliva which promotes tooth growth in rats and which lowers serum calcium in rabbits. The effect on tooth growth and on serum calcium was similar and the same substance apparently causes both effects. The activity could be increased by making the saliva alkaline (pH 9.6 to 10) or even more by allowing the cold alkaline solution to stand for 48 hours. A similar or identical material was isolated from bovine and rabbit parotid glands. This effective principle was named parotin. It was soluble in alkaline solution, and precipitated at pH 5.4 but dissolved in stronger acids. It was insoluble in almost all organic solvents. No pronounced decrease in activity was brought about by digestion with pepsin and trypsin. The

91. Koch, F. C. In Endocrinology and metabolism, vol. 2, Barker, L. F.; Hoskins, R. G., and Mosenthal, H. O., editors. New York, D. Appleton & Co., 1922, p. 736.

92. Higashijo, T. Histologische Studien über die Einfluss der Speichel-Druesen-Extirpation auf die Wirkung des Geschlechtshormones. (Abst.) J.A.D.A. 28:862 (May) 1941.

93. Lacassagne, A. Dimorphisme sexuel de la glande sous-maxillaire chez la souris. Compt. rend. soc. de biol. 133:180, 1940.

94. Ginn, J. T., and Volker, J. F. Rusting in desalivated albino rats. Endocrinology 31:282 (Aug.) 1942.

95. Beerstecher, E., Jr., and Altgelt, S. Apoerythein in saliva. J. Biol. Chem. 189:31 (March) 1951.

96. Beerstecher, E., Jr., and Edmonds, E. J. Anomalous thermal behavior of salivary apoerythein activity. Science 114:412 (Oct.) 1951.

97. Ogata, A., and others. Chem. Abstracts 45:687, 3485, 1951.

aqueous solution gave positive reactions to general color and precipitation reactions of proteins.

Authors' Note • Several important studies of salivary proteins have appeared since the submission of this review. Simmons[98,99] has studied human and cat salivary proteins and the submaxillary protein of the pig.

A study of the precipitability and electrophoretic behavior of human saliva has been made by Reid and Pigman.[100]

The amino acids of saliva have been studied recently by Cain and Berry[101,102] and by Moor and Gilligan,[103] by the paper chromatography method.

98. Simmons, N. S. The investigation of submaxillary mucoid and the defense mechanisms of the mouth. Thesis, department of pathology, University of Rochester, Rochester, N. Y., 1950.

99. Simmons, N. S. Studies on the defense mechanisms of the mucous membranes with particular reference to the oral cavity. Oral Surg., Oral Med. & Oral Path. 5:513 (May) 1952.

100. Reid, A. Jane. Carbohydrates and proteins in saliva. Master's thesis, biochemistry department, University of Alabama, Birmingham, Ala., 1952.

101. Cain, L., and Berry, H. K. IV. Quantitative study of urinary and salivary amino acids using paper chromatography. Austin, University of Texas Publication No. 5109, 1951, p. 71.

102. Berry, H. K. XVII. Further studies on individual urinary and salivary amino acid patterns. Austin, University of Texas Publication No. 5109, 1951, p. 157.

103. Moor, J. R., and Gilligan, D. R. Paper partition chromatography of free amino acids and peptides of normal human saliva. J. Nat. Cancer Inst. 12:691 (Dec.) 1951.

Production of Antibiotics • The ability to produce antibiotics is widely distributed among microorganisms. However, it is not a generic or even a specific characteristic, but is limited to certain strains within a given species. The variation in the production of antibiotics is both quantitative and qualitative. Strains of *Penicillium notatum* and of *P. chrysogenum* vary in their capacity to form penicillin between less than 1 unit and more than 1,000 units per 1 ml. of culture medium. The composition of medium and the conditions of cultivation greatly influence the amount and even the nature of the penicillin produced. Various strains of *S. griseus* differ greatly in their ability to form streptomycin: some give rise also to other antibiotics, such as actidione and streptomycin; some form no streptomycin, but only other antibiotics; whereas some form no antibiotics at all. The problem is thus not only to find a given organism which forms a certain antibiotic, but also to find one that produces the particular antibiotic in sufficient concentrations to justify its practical manufacture. *Selman A. Waksman, Ph.D., Frontiers in Medicine, The March of Medicine, 1950, p. 110.*

BUREAU OF LIBRARY AND INDEXING SERVICE

New technical and dental health films added to library

The film library of the American Dental Association, since its reorganization in 1952, has purchased six new titles and 12 prints of dental health films. These cover fluoridation, community health and dental care.

The technical film collection, formerly consisting of 13 titles and 17 prints, has now been increased by 23 titles and 44 prints. These films, which cover such subjects as operative dentistry, periodontics, exodontics, denture construction, oral surgery, pulp canal therapy, and oral pathology, have been produced by the United States Navy Bureau of Medicine and Surgery, Dental Corps, the University of Minnesota School of Dentistry, and individual dentists.

All of these technical films, photographed in color, are excellent for teaching purposes and are suitable for undergraduate and postgraduate dental students, as well as for practicing dentists. What makes many of them valuable as teaching aids is their brevity and the excellent close-up shots of gingival surgery and root canal treatment, surgical implants and cavity preparation. The time element is important since a few points are stressed in a short time, making them easily adaptable for program or instructional use. The use of patients, plaster models, "before and after" roentgenograms, and animation also add to the visual interest. A well organized film employs these forms and where the film is intended for teaching, usually concludes with a summary.

The silent films included in this group have explanatory titles and legends which make them self-explanatory. They can be shown with or without a narrator. A listing of these films as a supplement to the 1952 catalog should be ready for distribution after September 15, 1952. From time to time reviews of the new films in the collection will appear in THE JOURNAL. Detailed reviews of two of the films follow:

FILM REVIEWS

Interchangeable Duplicate and Triplicate Dentures • 16mm., color, silent, showing time one hour. Produced in 1948 by Frederick S. Meyer, D.D.S. Procurable on loan ($2.50) from the American Dental Association Film Library, 222 East Superior Street, Chicago 11, Ill., and on loan or purchase from Dr. F. S. Meyer, 519 Medical Arts Building, Minneapolis 2, Minn.

This film shows every step in the process of building dentures by the generated path technic. It demonstrates the construction of these dentures out of the mouth and shows how to achieve accurate balance and function so that no occlusal adjustment is necessary after insertion of the dentures in the patient's mouth.

The photography is good. All the close-ups are clear. Complete titles and legends make the film self-explanatory. The presentation is well organized. This film is suitable for undergraduate and postgraduate dental students and practicing dentists.

The Biologic Approach to the Periodontal Problem • 16mm., color, sound, approximately 1,200 feet, showing time 30 minutes. Produced in 1951 by Abraham Berliner, D.M.D. Narrated by Abraham Berliner. Photography by

John J. Carroll, ADTFC. Operative and restorative dentistry by Morris Bernstein, D.D.S.; Barton Goldberger, D.D.S., and Biagio Pinto, D.D.S. Procurable on loan ($2.50) from the American Dental Association Film Library, 222 East Superior Street, Chicago 11, Ill. and on loan or purchase from Abraham Berliner, D.M.D., 30 Central Park South, New York 19, N.Y.

This film, prepared for the purpose of demonstrating a course of periodontal treatment which has been used by Dr. Berliner for many years, is well organized and covers such steps as preparation for instrumentation, oxygenation, gingival surgery, epithelial stripping and improved home prophylaxis. Under "Instrumentation," various kinds of splints are demonstrated on patients suffering from periodontal disease. Stainless steel ligatures and hairpin splints are included among these as well as the clasp splint which is removable and easily cleansed by the patient. In gingival surgery, a plastic bandage used over the wound to protect the surface is shown, which maintains the blood clot and enables the patient to eat more comfortably. The film concludes with a series of cases demonstrating the interrelation between periodontal treatment and rehabilitative procedures. The narration is clear and slow enough for teaching purposes. The photography is good. All the close-up shots are clear. This film is suitable for undergraduate and postgraduate dental students, practicing dentists, oral surgeons and periodontists.

COUNCIL ON DENTAL RESEARCH

List of certified dental materials

Samples of the certified hydrocolloidal impression materials—agar type—in the following list were recently retested by the American Dental Association Research Fellowship at the National Bureau of Standards under the supervision of the Bureau. These materials were found to comply with American Dental Association Specification No. 11 for Hydrocolloidal Impression Materials. This list supersedes that published in the July 1951 issue of THE JOURNAL (page 83) and an addition to the list published in the April 1952 issue (page 449).

CERTIFIED HYDROCOLLOIDAL IMPRESSION MATERIALS—AGAR TYPE
(A.D.A. SPECIFICATION NO. 11)

Material	*Manufacturer or Distributor*
Coe-Loid—66	Coe Laboratories, Inc.
Deelastic	Kerr Manufacturing Co.
Dentocoll	The L. D. Caulk Co.
Elastic Colloid	The S. S. White Dental Mfg. Co.
Kerr Hydro-Colloid	Kerr Manufacturing Co.
Perfectocoll	Baker & Co., Inc.
Plasticoll	Lee S. Smith & Son Mfg. Co.
Surgident	Surgident, Ltd.

Ad interim report of the dental research activities at the National Bureau of Standards

This ad interim report covers the dental research activities of the Bureau of Standards from October 1951 to April 9, 1952 and has been approved by the Council on Dental Research for publication.

DENTAL MATERIALS

Certification and Specification Program • Two amalgams, 12 gold alloys, one mercury, five acrylic resins, and one hydrocolloid impression material, which were certified by their respective manufacturers to comply with the appropriate American Dental Association Specification and found to comply, have been added to the List of Certified Dental Materials. The certifications of one amalgam and five gold alloys were rejected because of failure to comply with the American Dental Association Specifications.

Reproducible tests on the solubility and sorption of the self-curing denture base resins and on specimens 0.5 mm. in thickness were completed. The design of an accurate test for reparability that can be consistently reproduced has not been solved. These two items have delayed the completion of the revision of the American Dental Association Specification No. 12 for Denture Base Materials.

Data are being collected for the alginate type of hydrocolloidal impression material for the formulation of another specification.

A survey of dental x-ray films is being made primarily with the possibility of formulating an American Dental Association Specification for Dental X-Ray Film. A cooperating group of the profession is assisting.

Retesting is under way for impression compounds (A.D.A. Specification No. 3), inlay casting waxes (A.D.A. Specification No. 4), dental mercuries (A.D.A. Specification No. 6), and wrought gold wire alloys (A.D.A. Specification No. 7) which are on the current List of Certified Dental Materials. A similar survey of the hydrocolloidal impression materials (agar type) (A.D.A. Specification No. 11) is nearly completed.

It may be of interest to note that the program of certification retesting and the necessary revisions of specifications is occupying an increasingly larger portion of the available time of the staff. As the number of products on the List of Certified Dental Materials increases and as new specifications are developed, additional time must be allocated to this phase of the work. As an indication of the volume of work involved, approximately 1,100 individual tests were required in this part of the program as covered by the report.

In addition to the work on the certification program, research investigations are in progress on the following materials.

Self-curing Denture Base Resins: Color Stability • Self-curing acrylic resins are known to be less color stable than heat-cured acrylic resins. Because of the poor color stability and the lack of an adequate quantitative color test, an attempt is being made to develop a suitable test using the Hunter Multipurpose Reflectometer. Such a method will enable one to identify color according to the International Commission on Illumination color coordinate system and the changes in color as NBS units of color difference.

Plastic Teeth: Abrasion Resistance • One of the serious problems encountered in the use of plastic teeth is their low resist-

ance to abrasion. Values reported for abrasion by various investigators differ markedly and to date it appears that the data depend on the type of test method and type of abrasive used. None of the methods investigated in the laboratory of the National Bureau of Standards or those employed by others appear to be adequate to evaluate the wear resistance of plastic teeth in service. Further investigations in this field are essential.

Acrylic Resin: Crazing • The appearance of craze lines in the surface of dentures or teeth of acrylic resin is the result of the release of strain in the surface of these resins. Data have been obtained which demonstrate that one of the primary factors causing strain is the exposure of the surface of the resin to water, either in the liquid or vapor state, at elevated temperatures during processing of the resin. It is believed that the high sorption of water at elevated temperatures causes expansion and subsequent release of this water below the glass temperature causes shrinkage and places the surface under tension. Data have also been obtained which show that the amount of water sorption and crazing are functions of the molecular weight of the resin. High molecular weight materials absorb less water and exhibit less crazing than low molecular materials. This observation points out the possibility of developing a resin for dental use which will be craze resistant.

Acrylic Resin: Premature Polymerization at Room Temperatures • Repeated observations have been made that some brands of acrylic monomer, which meet the requirements of American Dental Association Specification No. 12, solidify during storage at room temperatures. The recent studies of the effect of impurities on the polymerization reaction at elevated temperatures are being continued at lower temperatures in order to work out the fundamentals and kinetics of the polymerization reaction with the view of determining and eliminating the conditions causing premature polymerization.

Acrylic Resin: Bonding of Resins to Resin Surfaces • Similar experimental work to that completed on the bonding of plastic teeth to heat-cured resins is being done on the bonding of teeth to self-cured resins. All the data to date show that no chemical bond exists between plastic teeth and self-cured resins when they are processed by the usual dental technics and the teeth are held by mechanical retention only. Investigations are now in progress to determine the fundamental principles involved in the bonding of resin to resin surfaces and to develop, if possible, a technic which will overcome the lack of bonding with self-cured acrylic resins.

Acrylic Resins: Self-curing Acrylic Reliners • These materials are being investigated with respect to their effect on the denture. Data on the change in dimension of dentures in service, change in strength and other properties are being collected.

Amalgam • The temperature at which amalgams are prepared should have a considerable effect on the rate of amalgamation and the properties of the finished amalgam. Studies of amalgam prepared over a wide range of temperatures are being made. This work also includes the temperature effects caused by mechanical amalgamators.

The installation of a high frequency induction furnace has enabled work to be initiated on the formulation of experimental silver alloys in which deoxidizing agents other than zinc are employed.

Gold Castings: Casting Conditions • A systematic study of the casting temperatures with respect to the melting range of gold alloys, the effect of the melting range, and the mold casting conditions

is in progress in order to define optimum conditions.

Gold Castings: Excessive Fin Formation • Excessive formation of fins on partial denture gold castings occurs with some investing materials when the cast is dried by preheating before a resin-wax dip is made. Data which have been obtained show that some investments, when they are given a preliminary drying, change the coefficient of thermal expansion. The preheating may cause an increase or decrease in the total expansion of the investment. When the thermal expansion of the model increases even slightly over the surrounding investment, cracks develop and fin formation occurs.

Metalizing Mold Surfaces • The possibility of using metal alloys to spray mold surfaces in fabricating acrylic dentures is being investigated. If this method can be developed it will overcome the disadvantages of both tin foil and tin foil substitutes.

Artificial Dentures: A Study of Stabilization Factors • A mathematical study of the masticatory forces has indicated methods for improving stabilization of full dentures. A similar study is being made of the factors which affect the stability of partial dentures.

CLINICAL INVESTIGATIONS

Additional laboratory and clinical evidence has become available showing that there is a fluid exchange at margins of plastic fillings caused primarily by the difference in the coefficient of thermal expansion of the tooth and the resin. Enamel margins of cavities filled with plastics often show severe decomposition after several months.

Restorations of self-curing acrylic resins are being placed in vital teeth by the method advocated by Frank H. Nealon. In this technic the filling is painted in layer upon layer. A comparison of these restorations with those made by the conventional matrix method will be made.

ENAMEL AND DENTIN

Fluorescence • A method has been developed and equipment has been designed and constructed for recording the fluorescence of tooth structures. Most of the initial difficulties in the preparation and mounting of teeth for irradiation by ultraviolet light have been overcome. Photographs made by the fluorescence of teeth show structures not revealed by photographs made with white light. The development of this equipment and technic has produced a valuable method for investigating tooth structure. Work is in progress to extend this method for investigating the fluorescence of microareas (10 square microns) of teeth.

In addition to the above work on the fluorescence of tooth structures a method for investigating the spectrum of fluorescence has been in progress. The successful development and construction of an extremely high intensity ultraviolet light source for irradiating have made it possible to study the character of the fluorescence emitted. It is hoped by this method to investigate the composition of small areas throughout the tooth structure.

Crystal Structure • In the crystallographic investigations data have been obtained which prove that tricalcium phosphate hydrate, which closely resembles the inorganic part of dentin, is a hydroxy apatite with phosphoric acid inclusions. This observation may account for the fact that dentin and enamel have essentially the same roentgen-ray diffraction patterns although they have different calcium-phosphate ratios. The carbonate content of a tooth may also be present as adsorbed material and work is in progress to prepare a synthetic car-

bonate apatite in order that a similar investigation may be made.

Equipment is being designed and constructed which will enable low angle scattering roentgen ray technics to be employed in these investigations. An apparatus for cutting and polishing tooth sections of 25 microns thickness, a recording spectrograph, an electron microscope, and photomicrographic equipment have been purchased for this program, costing approximately $31,000.

MISCELLANEOUS

Use of Certified Dental Materials by Dental Schools • A query was sent to all dental schools in this country asking to what extent they were using products on the List of Certified Dental Materials. Twenty-eight schools who replied were utilizing the list extensively as a procurement guide. No replies were received from 14 of the institutions.

Publications Since Annual Report (1951) •

"Deterioration of Silicate Cements in the Tropics" by Theodore E. Fischer and Irl C. Schoonover, *U. S. Armed Forces Medical Journal,* June 1951, page 907.

"List of Certified Dental Materials Revised to March 1, 1951," *The Journal of the American Dental Association,* July 1951, page 78.

"Products Added to A.D.A. List of Certified Dental Materials," *The Journal of the American Dental Association,* October 1951, page 495.

"Product Added to A.D.A. List of Certified Dental Materials," *The Journal of the American Dental Association,* January 1952, page 81.

"The Effect of Molding Processes on Some Properties of Denture Resin" by A. H. Grunewald, George C. Paffenbarger and Irl C. Schoonover, *The Journal of the American Dental Association,* March 1952, page 269.

"Fluid Exchange at the Margins of Dental Restorations" by Robert J. Nelsen, Robert B. Wolcott and George C. Paffenbarger, *The Journal of the American Dental Association,* March 1952, page 288.

"Properties of Self-curing Denture Base Resins" by H. J. Caul, J. W. Stanford and A. F. Serio, *The Journal of the American Dental Association,* March 1952, page 295.

"Bonding Plastic Teeth to Heat-cured Denture Base Resins" by I. C. Schoonover, T. E. Fischer, A. F. Serio and W. T. Sweeney. *The Journal of the American Dental Association,* March 1952, page 285.

In addition to the articles which have been published, an article entitled "Crystallographic Investigation of Tricalcium Phosphate Hydrate" by Aaron Posner and Samuel R. Stephenson has been submitted to the *Journal of Dental Research.*

Presentation of Reports • Reports of the work were presented before the Sections on Operative Dentistry, Prosthodontics: Full Dentures, Research, and Roentgenology of the American Dental Association; the Hudson County Dental Society of New Jersey; Greater New York Dental Meeting; 11th Annual Midcontinent Dental Congress; St. Louis Dental Assistants Society; Richmond (Va.) Dental Society; International Association for Dental Research; California State Dental Association; California State Laboratory Association; Salt Lake City Dental Society; Postgraduate Clinic, District of Columbia Society; the Monongahela Dental Society, and Western Reserve University Alumni Association.

COUNCIL ON DENTAL HEALTH

Fourth annual National Children's Dental Health Day: report of progress

The nationwide reports on the activities and achievements of the fourth annual National Children's Dental Health Day are summarized in John E. Gurley's foreword to the program which the California State Dental Association prepared for that occasion: "All of this will add up to Prevention spelled with capital letters."

Although it would be desirable to provide a complete report of the activities held throughout the country this year in conjunction with National Children's Dental Health Day, incomplete replies to many queries contained in the questionnaire issued by the Council on Dental Health, as well as failure to return many questionnaires, limited the scope of the Council's survey. Replies received, however, indicate the acceptance of the foregoing point of view on prevention. Effects ranged from arousing interest in dental health among both lay and professional groups to interest in and ultimate adoption of community dental programs, including fluoridation of public water supplies.

An analysis of the many reports received from state and local communities indicated that both children and parents are becoming more conscious of dental hygiene, that dentists are taking more interest in pedodontics and are participating in more community activities, that more adults understand why deciduous teeth require proper care, that interest in and knowledge of dental health is increasing among grade school teachers, that interest in individual oral hygiene has improved, that there is more cooperation from state nutritionists, that radio executives want dental health programs oftener than once a year, and that the public, including civic, health and school officials, are exhibiting a growing appreciation of the dental profession's efforts to promote dental health education for children.

"Success begins at the local level" was emphasized in some reports. Success can best be accomplished by better public relations, and some communities recommended that officers of their component societies be advised to set up funds for public relations programs. The roster of groups cooperating with dental societies in the observance of Children's Dental Health Day indicates a dramatic potential for community programs when interest is awakened and ideas for execution are made available.

Recommendations for more dental health education at the college level were included in many of the community reports. Other reports expressed a need for more education in children's dentistry at the parent level.

In addition to proclamations from mayors of numerous communities, the governors of 18 states and the Commissioners of the District of Columbia were reported as officially proclaiming the observance. More than 30 scientific meetings were sponsored and a slightly higher number of public meetings were held.

Akron, Ohio, reported: "Full school examinations, followups by nurses, and the services of a school emergency clinic are the results of past programs." Ft. Morgan, Colo., reported that 90 per cent of the children examined there have received dental care regularly.

Newspaper and radio publicity was extensive and television was employed in most areas served by this newest medium. In Pennsylvania, the dentists

of Elk and Cameron counties paid for spot announcements to advertise a radio show on which a panel of dentists answered dental health questions sent in by listeners. The station furnished the time as part of its public service. The volume of questions led to a second broadcast and, as a result of these panel discussions, plans were made for the group to return for an hour's program devoted to fluoridation.

Poster contests were conducted in some 30 communities; a slogan contest was featured at Buckhannon, W. Va., and essay contests were held in Phoenix, Ariz., Rockford, Ill., and in New Jersey.

A poster contest at Charlotte, N.C., attracted more than 10,000 entries from city and county school children. Conducted throughout the week of February 4, activities included a puppet show presented by a group of seventh grade children who made, costumed, named and manipulated the puppets and wrote and produced the show. In February, members of the Charlotte Dental Society had examined the teeth of more than 20,000 children. During the following months the teeth of the preschool and primary grade children were examined.

The New Hampshire Nashua District Dental Society, using a mobile trailer, took more than 350 bitewing roentgenograms. Omaha, Neb., dentists employed a trailer fitted with x-ray equipment and a slide projector to publicize the benefits of fluoridation and roentgenographic examinations. The Waterbury, Conn., Dental Society donated a dental film to the public schools, increasing the visual education department's film library.

Fluoridation of the water supply at Forest, Miss., population 2,800, was begun on February 5. Financial aid was obtained from civic clubs to help purchase equipment.

At Shreveport, La., the Fourth District Dental Association distributed the American Dental Association's pamphlets, *Toothbrushing* and *Fluoride: Less Tooth Decay.*

In Washington, D. C., where radio and television were used extensively, 10,000 pieces of literature given by a milk producers' association and 10,000 pamphlets donated by a life insurance company were distributed. A full-page advertisement, sponsored as a public service by a local firm, dramatized, "First Tooth—A Community Problem."

The Cleveland Dental Society honored the founder of Children's Dental Health Day, Norman H. Denner, at a testimonial luncheon and presented him with a scroll of appreciation. The observance was the twelfth in Cleveland, where the event originated in 1941.

The Detroit District Dental Society sponsored a "Children's Dental Festival" which was featured by a health contest judged on health, occlusion and beauty.

Its greatest effort since the inauguration of National Children's Dental Health Day marked the New Jersey State Dental Society's fourth annual observance of the occasion. The state committee's endeavor was extended to 72,500 children. In Morris, Sussex and Warren counties, an estimated 10,000 parents were reached with dental health education materials through the Tri-County Dental Society's distribution of dental kits to 5,000 kindergarten children.

A reader's letter published in one of the Denver newspapers thanked the Denver Dental Society and the newspaper for a series of articles on dental health for children. "Prevention" was the keynote of the reader's conclusion: "It is a shame that although research has so much knowledge to offer us for avoiding tooth trouble, still ignorance and apathy continue to spoil good teeth, causing misery and wasting time and money. Today's best dentist must be far more a missionary than a repairman. He is happier to help his patients keep their teeth than to give them new ones. For better teeth in our time and in coming generations, let's not be just willing subjects for repair work, let's be converts to the mission of dental health."

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THE Journal OF THE AMERICAN DENTAL ASSOCIATION

Editorials

Illogical report of Congressional committee recognizes and ignores benefits of fluoridation

A report filed last July with the United States House of Representatives by the House Select Committee to Investigate the Use of Chemicals in Foods and Cosmetics has been used in various communities by opponents of water fluoridation in a desperate effort to bolster their arguments against employing this demonstrated anticariogenic measure.

Close study of the lengthy report does not justify its use for that purpose. Members of the Select Committee in their report recognize the benefits of fluoridation, cite endorsements of it by highly qualified and reputable organizations and acknowledge that there are no known hazards in the fluoridation of drinking water in amounts up to one part per million. The Committee concludes, however, that since "dental decay does not constitute a serious danger to health," communities should exercise caution in adopting the water fluoridation measure; the Committee recommends that topical applications of sodium fluoride be used as a substitute.

In the light of present knowledge, this recommendation is archaic. The Committee chose either to ignore or to distort the favorable reports of all the leading health agencies in the country in regard to the measure. At hearings held last February, the Committee disregarded the testimony of representatives of the Association and accorded harsh treatment to other witnesses who testified to the safety and benefits of fluoridation. The scientific facts about fluoridation speak for themselves; they have been recognized and accepted by every important national organization concerned with public health and medical and dental practice. Representatives of the

Council on Dental Health and of the Council on Dental Therapeutics of the Association present their analysis, based on a careful study of the report, on page 475 of this issue of THE JOURNAL. Members who read it will agree that the value of a scientific discovery such as the anticariogenic effect of water fluoridation cannot be determined by a show of hands among members of a Congressional committee.

Germany abolishes sublevel dentistry

Concerned over the constantly lowering standards of dental service, the Federal Republic of Germany last March enacted legislation which revamped its regulations for dental education and dental practice.[1] For more than three quarters of a century, Germany had experienced and experimented with a dental health program built on a two-level system of education and two-level system of service. The Zahnarzt, or university educated practitioner, had rendered the elite type of service, while the Dentisten, or unqualified practitioners, only technically trained, cared for the dental needs of the great mass of the people.

Henceforth, German dentists entering the profession, must have completed successfully an approved formal course in dental education. The training and recognition of Dentisten have come to an end although these unqualified dentists who have already been in practice may acquire approbation and continue in practice provided that they meet certain conditions prescribed by the new law.

In passing this legislation, Germany has recognized and has attempted to correct, after 83 years, an unsavory, unhealthy condition, which Britain recognized in that country some 30 years ago when Parliament passed the Dental Act of 1921. Prior to that time dental service in Britain, like dental service in Germany, was rendered by two types of practitioners: those with a university education and those with only technical training. Britain recognized in 1921, as Germany has come to recognize in 1952, that no nation can condone a double standard of health service for its people.

A two-level system of dental practice is understandable only when a population is too poor to support a fully qualified profession or when the legal requirements for the practice of dentistry are inordinately high. Neither explanation applies to England and Germany, but the situation in Austria, before World War II, and that in Italy and Portugal at present fall in the second category. In countries where the full-fledged dentist must have a medical degree and pursue the training of an oral surgeon in order to qualify, the two-level system of dentistry results. In Austria prosthesis originally was regarded not so much as a professional service as a commercial transaction. The Zahntechniker, without professional education, in the earlier days was licensed to supply patients with any sort of dental prosthesis. Because he was unable to accomplish this service without surgical preparation of the patient, he soon was authorized to extract teeth, and before long, he was permitted to place fillings and inlays and perform other operations so long as they could be construed as preparation for prosthesis. The Zahntechniker soon enjoyed the privileges and re-

sponsibilities of the Zahnarzt, or dental physician, without having to undergo his long and arduous training. Such an outcome may be expected wherever the law requires that the dentist must also be a graduate physician. The inroads of the unqualified practitioner are insidious and follow whenever the legal requirements are either too low or too high.

The experience of our European neighbors should serve as a warning here. But despite the lessons which Britain, Germany, and some other countries have learned the hard way, some persons would have us repeat these errors. Some would establish large multi-chaired clinics with a superdentist in charge directing the services of lesser trained men. Some would partially train young women to perform certain dental operative services for children, and some would license dental laboratory technicians to perform certain types of intraoral service. Double standards of dental service did not work in Britain, they did not work in Germany, and they will not work here. American dentists will watch with interest the development of the profession in Germany under the new regulations.

1. See News of Dentistry, this issue.

Blue-penciling the superfluous in dental articles

At the joint conference of the Council on Journalism and the American Association of Dental Editors last June, various helpful means were proposed through which the state journals, already admirable, may enhance their service to the profession. This recognition that there are opportunities for improvement at the state level has suggested the desirability of self-examination among dental journals of national scope. THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION, for one, proposes some salutary introspection to determine whether advances of scientific and professional journalism in recent years call for any revision of its journalistic standards.

A glance through periodicals in related fields, the medical and scientific journals, gives evidence that their prevailing literary requisite is economy of expression. High printing costs and the crowded calendar of the practitioner necessitate conserving the journal's space and the reader's time. Dental journalism, however, continues in the main to pursue a leisurely course, tolerating digressions, nonessentials, circumlocutions, and the repetition of common knowledge. Contributors exercise little self-restraint, and editors are overindulgent. Yet, observance of the principle of economy, when rightly understood as developing the subject to exactly the necessary sufficiency but allowing no jot of excess, will greatly enhance the worth of valuable contributions.

Many of the articles published in THE JOURNAL conform to standards of compactness, directness, and cogency. But the criteria of good scientific journalism have not been met consistently. THE JOURNAL proposes to set up uniform standards of exposition as high as those it now maintains for scientific and professional subject

matter. Four of the most common weaknesses found in many dental articles are: superfluous appendages, multiple or diffuse subject matter, rehashing of previously published material and wordiness.

Superfluous appendages such as prefatory amenities, introductory remarks, running starts, unmotivated reviews of history and literature, and explanations designed for a special audience have no place in a scientific journal. Such redundancies probably are explained by the fact that most articles were originally delivered orally and their authors have not rewritten them for publication. The author's removal of these superfluities will spare the editor the necessity of wielding the blue pencil.

Uncertainty or multiplicity of purpose often leads an author to write a dual article, one half dealing with one phase of the subject and the other with quite another aspect. It is unnecessary, for instance, to precede an account of a case or a group of cases by a theoretical discussion of the well-known etiology and pathology of the condition involved or in the presentation of a technic to trace the whole related branch of dentistry from earliest times. It is to be assumed that the intelligent professional reader is familiar with the textbook knowledge of his subject. It is also more logical and more effective to confine the article to a single unified aspect of the subject.

In articles dealing with modifications of older, generally known technics and methods, it is desirable to present only the variant features introduced by the author. Since most of the procedure is already familiar to the reader, it is necessary only to indicate at what points in the general technic the modifying steps come in. So handled, the contribution of the author will secure the prominence that its originality deserves. Otherwise it will be buried in the midst of commonplace routine.

In matters of diction, the most wasteful practice is that of employing circumlocutory phrases in place of straightforward statement. For example, to say "institute surgical interference" for "operate" is both ineffective and wasteful. Simple facts do not acquire greater significance through inflated language.

In asking contributors to cooperate in the observance of these principles of economy, THE JOURNAL imposes no crippling limitations on the author and sacrifices no valuable part of his effort. The article, divested of extraneous matter and reduced to direct statement, will gain in clarity, purpose, force, and intelligibility, to the greater credit of its author and fuller satisfaction of the reader.

An analysis of the Delaney Committee report on the fluoridation of drinking water

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In mid-July, a special committee of the U. S. House of Representatives, known as the Select Committee to Investigate the Use of Chemicals in Foods and Cosmetics, issued a report (*J.A.D.A.*, August, 1952, p. 243) urging communities to adopt a "conservative attitude" toward the fluoridation of domestic water supplies. The Committee was headed by Rep. James J. Delaney (D., N. Y.). Copies of this report have been distributed widely. Since it appears as an official publication of the 82nd Congress, the report has been interpreted by some individuals as a reversal of the complete endorsements of fluoridation which have been made by health agencies of the federal government. Such is not the case. The report is simply an expression of opinion of its seven members. While vaguely negative in its recommendations, the report itself reiterates the fact that fluoridation has been endorsed and recommended by such federal agencies as the U. S. Public Health Service, and the quasi-official National Research Council. The recommendations of the report, which also included a separate statement by Rep. A. L. Miller (R., Neb.), for the most part ignore the testimony of government scientists and representatives of such organizations as the American Dental Association, American Medical Association, American Public Health Association, Association of State and Territorial Health Officers and many others. In effect, the report was a deferred minority report on the action of Congress itself which earlier had approved an appropriation of funds for the fluoridation of the public water supplies in the District of Columbia. The fluoridation of the public water supplies in the District of Columbia and surrounding communities, with the approval of the full Congress, was in effect prior to the official release of the report of the Committee. The report makes no recommendation for any legislative action by the federal government.

Staff members of the Councils on Dental Therapeutics and Dental Health have carefully analyzed the report of the Delaney Committee as follows.

Serious defects of the recent report on the fluoridation of community water supplies as issued by the House Select Committee to Investigate the Use of Chemicals in Foods and Cosmetics resulted from the failure of the Committee to utilize evaluating procedures that would be acceptable to a scientific group. No responsible scientist or scientific body would be satisfied with the Committee's evaluating technics, as shown by the following examples:

1. The report reads in part that "eighteen witnesses, qualified by their background and training . . . presented their views and recommendations." This statement implies that the Committee carefully selected individuals who were qualified experts through their participation in fluoride research or through their

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demonstrated familiarity with the several hundred publications which have reported original studies in the field of fluoridation and its related aspects.

An examination of the list of witnesses who appeared before the Committee suggests that several of the individuals who were invited by the Committee during the early stages of the hearings had not made any studies of significant magnitude dealing with fluorides and did not appear to have adequate background to warrant their testifying as experts in this matter. In fact, some of the witnesses stated that their testimony reported only their personal views. In its conclusions the Committee did not differentiate between the degree of reliability to be attached to the statements of the various witnesses.

2. Some witnesses referred to investigations by other individuals and the allegations of the witnesses were not verified by the Committee through testimony by the original investigators. As a result there was misinterpretation. For instance, the report asserts: "Recent reports of laboratory research indicate that the effect of fluorides on dental decay may possibly be influenced considerably by the absence or presence of magnesium in water." This assertion relates to the investigations reported by A. E. Sobel. Dr. Sobel has reported that statements of this type are not correct.[1] He said that his findings should not be interpreted to question the value of fluoridation. Furthermore, the Committee apparently did not seek further direct evidence on this point. Such evidence is readily available in the literature.[2] A comparison of the analyses of water supplies in Colorado Springs, Colo., and in Galesburg, Maywood, Aurora, East Moline and Joliet, Ill., reveals a wide variation in the magnesium content of the waters while the amount of dental decay is low and is always inversely related to the amount of fluoride in the water supply. Thus, whatever the situation may be in test-tube studies, it is apparent that under natural conditions, the presence or absence of magnesium in the water supply does not decrease the dental benefits derived from the fluoride.

3. Another example of the Committee's failure to interpret properly a scientific report is in its statement, "It may not be safe for infants and other children suffering from malnutrition to drink fluoridated water." This statement refers to a study by Maury Massler and Isaac Schour.[3] Drs. Massler and Schour have since called attention to the misinterpretation of the results of their study and pointed out that their article calls attention to the role of malnutrition in increasing the severity of mottling and emphasizes the importance of sound nutrition under all conditions. They explained further that the scientific evidence on hand is sufficient to justify the fluoridation of water to 1 ppm with the assurance that there will be no untoward effect on general health.[4] Again the Committee failed to verify its interpretation through direct testimony from the investigators.

4. In view of the question in the Committee's report concerning the possibility of a difference between fluorides as added in controlled fluoridation and fluorides as they occur naturally in many public water supplies, the Committee should have requested further information from chemists having special knowledge concerning the ionic equilibria involving fluorides in aqueous solution. Published information was readily accessible to show that the speculation concerning the presence in water of fluorine

1. Studies show magnesium does not interfere with dental effect of water-borne fluorides. News Letter, Council on Dental Health, A.D.A. 7:7 (Dec. 5) 1951.

2. Dean, H. T., Epidemiological studies in the United States. In Dental caries and fluorine, F. R. Moulton, editor. Washington, D. C., American Association for Advancement of Science, 1946.

3. Massler, Maury, and Schour, Isaac, Relation of endemic dental fluorosis to malnutrition. J.A.D.A. 44:156 (Feb.) 1952.

4. Personal communication to A. O. Gruebbel from Drs. Massler and Schour, March 18, 1952.

in nonionic form or organic combination has no logical bearing on the consideration of the fluoridation procedure.

The analytical method which has been employed to measure the fluorine concentration in water is one *which measures the concentration of available fluoride ion.*[5,6] It is apparent, then, that the physiological effects of "natural" fluoride-bearing water are related to a fluoride ion, and it is also a fluoride ion which will be present in the water as a result of the addition of the compounds employed for controlled fluoridation.

In addition to the Committee's failure to utilize an adequate scientific approach, its report contains several statements and implications that are open to serious question.

The Committee does not conclude that there are hazards in fluoridation, but expresses a number of vague apprehensions. The Committee apparently ignores the mass of evidence derived from the experience of several million people who have used throughout their lifetime a drinking water with an equal or higher concentration of fluoride than that recommended for fluoridation.

In this connection, the report attached little significance to epidemiological studies. The report implies that an epidemiologic study is significant only for a group and not for individuals. It should be pointed out that group data are collected by examining individuals. The data from all individuals are not pooled in order to make the data applicable only for the group, but in order to obtain a higher degree of reliability as these apply to the individuals of the group.

The clinical examination of a few individuals will often fail to disclose effects that may be identified when the examinations are extended to a large group. This is especially important in a study of fluoride effects since the population groups are often naturally subjected to a higher concentration of fluoride than would be justifiable in a clinical test. Furthermore, the exposure may extend throughout the entire lifetime of the individuals in the selected group.

The "addition" or "pilot fluoridation" studies cannot be as crucial a test of safety as is the experience in communities where the fluoride ion concentration is naturally many times as high as that being added in the pilot studies such as those in Grand Rapids, Mich., Newburgh, N. Y., and Evanston, Ill. Bauxite, Ark., for instance, had approximately 14 ppm fluoride ion in its water supply. Bartlett, Texas, has about 8 ppm. There are at least 40,000 persons who during their entire lifetime have lived in areas in the United States where the drinking water contains at least 5 ppm fluoride ion. These conditions established by nature, not by men, provide the most convincing evidence of the safety of fluoridation at a level of about 1 ppm.

The Committee recognizes the lack of immediate toxicity of fluorides in the concentrations recommended for water supplies but again expresses vague concern over the possible cumulative effect. The report reads:

> The acute toxic effects of fluorides have little bearing upon the hazards which may be associated with its use in public drinking water for the purpose of reducing dental decay. As in the case of most chemicals used or proposed for use in food, the hazard, if any, will result from the cumulative action of small quantities ingested over a relatively long period of time.

Evidence available to the Committee through the report of the *Ad Hoc* Committee of the National Research Council[7] showed that if cumulative effects of fluorides did develop, they would first become evident in the bones and teeth; yet, no evidence of bone fluorosis could

5. The determination of the fluoride ion content of water. Quarterly Waterworks News of New York State 6:13 (Sept.) 1951.

6. Maier, F. J. Fluoridation of public water supplies. J. A. Water Works A. 42:1120 (Dec.) 1950.

7. Report of the Ad Hoc Committee on the fluoridation of water supplies. Washington, D.C., National Research Council, Division of Medical Sciences, 29 Nov., 1951.

be found in roentgenographic examinations of persons living in areas where the water contains from 1.2 to 3 ppm of fluorine. Even at a level of 8 ppm there was no evidence of bone injury and only minimal change in bone density in 11 per cent of those examined roentgenographically.

The Congressional Committee received a considerable amount of scientific information such as that just cited, and its report contains this paragraph:

> The major portion of the scientific opinion in this country is that the addition to communal water supplies of fluoride compounds, in a quantity sufficient to equal the proportion of about one part of fluorine to one million parts of water, presents no hazard to the public health. Such highly qualified and reputable organizations as the American Medical Association, the National Research Council, the American Public Health Association, the American Dental Association, and the Association of State and Territorial Health Officers have endorsed the program of fluoridating the public drinking-water supply. The United States Public Health Service has issued an unqualified endorsement of the program.

In spite of these scientific opinions as to the safety of fluoridation, the Committee chose to recommend " . . . that if communities are to make a mistake in reaching a decision on whether to fluoridate their public drinking water, it is preferable to err on the side of caution." This is, in effect, a recommendation for delay of a public health procedure on the basis of vague concerns which are contrary to the vast majority of scientific opinion as noted by the Committee.

Referring to the very mild mottling of dental enamel found in a few individuals living in areas where the water contains 1 ppm fluorine, the Committee states that "even so-called mild mottling may be unaesthetic." However, the investigators who have had the widest experience in observing mottled enamel agree that the mild fluorosis infrequently observed where water contains 1 ppm fluoride ion does not involve staining and is detectable only by a trained observer.

In spite of extensive testimony on the subject, the Committee report ignores the fact that all responsible groups who favor fluoridation recognize that water intake varies to a significant extent in relation to climate and humidity factors, and that health authorities recommend that the concentration of fluorine in public water supplies be adjusted accordingly. The amount of fluorides necessary to control caries in any region would always be less than that which would cause staining.

The Committee report states that witnesses testified that experiments are now in progress. It implies that adequate studies have not been completed. This latter implication is not correct and it is not in accord with the testimony of many of the witnesses who appeared before the Congressional Committee. All of the reports that have come, both from groups directing controlled fluoridation studies and from groups that have made population surveys in areas where the water supply contains many times the concentration of fluoride that is employed in controlled fluoridation, have indicated that the procedure is without hazard.

Furthermore, the statements that the effect of fluoridation on older age groups and on individuals with chronic disease will be known only after the extension of the Newburgh study and similar projects are incorrect. The most crucial investigations of the physiologic effects of fluorides have been made in areas where the water contains three to eight times as much fluoride as is being added in the Newburgh study. Several hundred thousand individuals, including people of all ages and of varying states of health, are included in these groups.

The Committee apparently disregards the magnitude of the health problem caused by dental caries and therefore assumes that vague apprehensions are sufficient to warrant delay of a public health procedure admittedly capable of greatly reducing tooth decay. The Com-

mittee apparently is not impressed by the fact that dental disease, primarily dental caries, was the greatest single cause for the rejection of inductees during the early period of World War II, and the fact that every year the American public spends more for the correction of the results of dental caries than for the treatment of any one other disease.

The Committee notes that it is not concerned with the term "mass medication" and then devotes about 10 per cent of its total report to this subject. A legalistic definition is developed to prove that fluoridation is "mass medication." It seems necessary only to point out that this all-inclusive definition must of necessity prove that the ingestion of food is medication since the food is obviously used to prevent the development of deficiency diseases.

The report asserts that there is no real similarity between chlorination and fluoridation. This conclusion is based on the difference in the immediate action or mechanism of the two procedures, one being used to destroy microorganisms, the other to provide increased resistance to caries. The Committee overlooks a similarity in principle; namely, the addition of a chemical to drinking water in order to greatly reduce the amount of disease. The narrow concept expressed in the report tends to obscure the fact that the addition of suitable chemicals is a universally accepted procedure for improving the quality of drinking water.

In a supplementary report, Representative Miller asserts that only children under eight years of age will be benefited by fluoridation, and concludes that only one person out of eight in the population will receive protection against dental caries. It is obvious that Representative Miller disregards the fact that the individuals drinking the fluoridated water during early childhood will retain the dental benefits throughout life. Eventually, therefore, the entire continuous resident population of a community will receive full benefits from fluoridation.

The Committee further attempts to justify delay of fluoridation by the assertion that there is a reasonable alternative to this procedure through the topical application of fluorides to the teeth of children. Although the Association recognizes the value of topical applications of fluoride, it is necessary to point out that such a program is not an adequate substitute for water fluoridation. The procedure cannot be adapted to the widespread application that would be necessary to prevent dental caries in a significant portion of the population. Representative Miller goes so far as to recommend alternative procedures which have much less scientific basis, such as addition of fluorides to milk or the use of fluoride tablets.

Representative Miller further implies that the Food and Drug Administration might take action against processors of foods prepared with fluoridated water. That this implication is not correct is shown in the statement of policy issued by the acting administrator of the Federal Security Agency, published in the *Federal Register* of July 23, 1952:

> **The Federal Security Agency will regard water supplies containing fluorine, within the limitations recommended by the Public Health Service, as not actionable under the Federal Food, Drug and Cosmetic Act. Similarly, commercially prepared foods within the jurisdiction of the Act, in which a fluoridated water supply has been used in the processing operation, will not be regarded as actionable under the Federal law because of the fluorine content of the water so used, unless the process involves a significant concentration of fluorine from the water. In the latter instance the facts with respect to the particular case will be controlling.**

In the supplemental report, Representative Miller states that: "I am convinced that many of the groups who now endorse fluorides in water are merely parroting each other's opinions. They have done no original research work themselves." This statement is entirely

misleading since many of the members of the organizations noted have participated directly in experimental studies, population surveys and other investigations which have demonstrated the safety and desirability of fluoridation. Consequently, the conclusions of these agencies reflect the expert knowledge of their individual members who have participated in the original work relating to this procedure.

The official actions of the American Dental Association and the American Medical Association, with respect to the safety and efficacy of fluoridation, were taken only after critical evaluations of research data. The evaluations were made by councils composed of many of the nation's outstanding medical and dental scientists.

In the supplemental report, Representative Miller refers to the statement of the American Medical Association inserted in the committee's hearings, and quotes from a portion of the statement.

The quoted statement was removed from context in order to suggest that the American Medical Association "did not give an unqualified endorsement for the use of fluorides in drinking water." Actually the American Medical Association has given full approval, both with respect to the safety and the desirability of fluoridating water supplies.

The American Medical Association did not "urge" adoption of the dental measure and explained in the hearing that "it was the opinion of the Council that this question [of recommendation for or against] should be answered by the dental profession." The American Medical Association's conclusion in the hearings reads as follows: "Fluoridation of public water supplies in a concentration not exceeding one part per million is nontoxic and its principle is endorsed."

CONCLUSIONS

The Delaney Committee report on fluoridation acknowledges that the preponderance of scientific evidence supports the conclusion that fluoridation is a safe and effective procedure for the control of dental caries. The Committee itself concludes that the efficacy of the procedure is amply demonstrated but expresses vague apprehensions concerning possible toxic action from a cumulative effect of the fluoride. The Committee, therefore, in effect recommends that communities should delay adoption of fluoridation pending the accumulation of additional evidence of the safety of the measure.

The Committee apparently was influenced by its lack of regard for the value of mortality and morbidity data in areas with fluoride as compared to areas without fluoride. It is our opinion that the Congressional Committee report suffers from a lack of adherence to the proper standards of investigative procedure as evidenced especially by its failure to substantiate many statements which it accepted as fact. The Committee also accepted misgivings of a few individuals who appeared as witnesses, in spite of the weight of the evidence furnished by such organizations as the American Dental Association, the American Medical Association, the United States Public Health Service, the National Research Council, the American Public Health Association and the Association of State and Territorial Health Officers. The Committee, through its statement that "dental decay is not contagious nor can it be said to constitute a serious danger to health," implies that a disease is not a community problem unless it is contagious and fails to recognize the fact that dental caries is the most prevalent disease of mankind.

In our opinion, the evidence to demonstrate the safety of the fluoridation procedure is so overwhelming that there is no justification for further denying to large numbers of children the benefits of better dental health which will result from this procedure.

International Correspondence

NEWS FROM GREAT BRITAIN

"The tumult and the shouting dies.
The captains and the kings depart. . . . "

This morning, 24 hours after the strains of "Auld Lang Syne" rose up and filled the vast auditorium of the Royal Festival Hall, no vestige of the Congress remains. The scientific exhibits have disappeared, the traders' stands have gone, the demonstrators' tables stand disconsolately empty and deserted. Only the whispering ghost of the busy hum of scientific disputation lingers in the corners where a stray wrapper shuffles uneasily in the breeze, awaiting collection.

What then has the Congress achieved? A great exchange of scientific knowledge at an international level, a clarification of many problems of dental education and social dentistry, a stimulus to research and a dissemination of technical contrivance? No doubt all of these will emerge when the transactions appear in the September, December, March and June issues of the *International Dental Journal;* but already an even wider significance may be seen to attach to the great gathering of nearly 5,000 members of the Congress derived from more than 75 different countries all across the world.

This significance emerges from the fact that so many members of our profession and their wives have spent a week in each other's company. They have banqueted together, have attended meetings and entertainment together, have laughed together and conversed, often using two or three languages in one conversation, seeking to bridge the international gap. New friendships have been formed, new horizons opened up, and the wave of good fellowship that swept the closing meeting bore eloquent testimony to the value of the Congress in the field of promoting better international relations in a world where nothing could have a higher importance or perform a greater service to humanity.

There are, however, great national advantages also to be gained from these Congresses. From the British standpoint dentists have never before had an opportunity of staging an exhibition to show their fellow citizens the degree to which they have evolved as an organized profession, their deep and abiding concern for the welfare of the community, or the extent and scope of their activities. The depth of the foundations of our profession in the bedrock of science, and the complexity of its specialized superstructure have never before been so adequately displayed.

Every nation represented at the Congress is wondering what it should do about socialized dentistry and is anxious to find out from the experience of others what is best and what most dangerous. Closely allied with this question is the problem of dental education for, broadly speaking, the longer, more liberal and more professionally complete the education of the dentist, the better and more versatile will he be in the practice of his profession—but the more expensive will be his services.

In these days few nations can afford to ignore the economic aspect of providing social service; thus, the prescription for the education of the dentist is closely bound up with the pattern of the dental service to be provided for the massed communities of each country all over the world.

The precise border line between specialized and general practice and the value of the delegation of duties to auxiliary workers can be discussed at an international level without raising the temperature of the debate, as often happens in more directly affected national circles. The relative importance of placing emphasis on basic scientific education or on meticulous technical training may be debated by experts in each camp; and in England we hope we were able to show how much we owe to our close association with medicine and yet how free we are to follow our star.

It is impossible to assess the extent to which our Congress has been of value in these speculative fields of human intercourse, but when they read the account of our transactions in the *International Dental Journal* for the ensuing year and when anyone speaks who was with us here—

> "Gentlemen in England now abed
> Shall think themselves accursed they were not here."

Well, perhaps that is going a little too far—but I for one would not have missed it for anything.

E. Wilfred Fish, London

Washington News Letter

A discussion of dentistry's problem which was held in Washington August 12 offers a virtual preview of what the President's Commission on Health Needs of the Nation may report on this phase of its current study. The Commission's task is scheduled to be completed by the end of this year, with findings and recommendations submitted to the White House by that time.

At the August 12 meeting, John C. Brauer, dean of University of North Carolina School of Dentistry, presented a summary of the panel discussion held here four weeks earlier on research and the education of physicians, dentists, nurses and allied professional personnel. Agreement was reached on the following suggestions for improvement of the status of dentistry:

1. Further studies to determine the resources needed for adequate dental care for all segments of the population.
2. Further studies of dental personnel requirements in relations to needs and demands.
3. Extension of dental health education.
4. Expansion and improvement of existing facilities for dental education and training, with new facilities to be developed only where genuinely needed.
5. Improvement and enlargement of dental faculties.
6. Programs for financial assistance to dental students where indicated.
7. Programs to improve inter-professional relationships within the realm of health services.
8. Development of community programs for preventive and remedial dental care to reach all persons, preferably under private, local community or state support and control. Special emphasis to be placed on preventive dental care for children. Indorsement was given the American Dental Association's statement that responsibility for dental care begins with the individual.
9. Continued expansion of dental public health programs.
10. Further establishment of local, state and national councils on dental health.
11. Greater support of dental research.

John W. Knutson, chief dental officer of U. S. Public Health Service, gave unqualified indorsement of the panel's summary. He expressed the opinion that this country is in need of more dentists and more hygienists, and deprecated the comparatively small sum of money invested annually in dental research.

Sole note of disagreement on a major issue came when Evarts Graham, St. Louis surgeon and a member of the Commission, challenged the panel's definition of dentistry: "The health service specifically concerned with the establishment, maintenance, restoration and improvement of the health, function and appearance of the oral cavity and its associated parts, in their inter-relations with other parts and with the individual as a whole."

Dr. Graham questioned whether, under that definition, the dentist and the otolaryngologist might not have jurisdictional troubles. Dr. Brauer explained that it is not unusual for the dentist and the physician to work together on cases.

FTC VS. ORTHODONTISTS

Because the Federal Trade Commission generally limits its "policing" to trade associations and business firms, Washington observers were taken by surprise August 8 when the FTC disclosed that it has filed a complaint against the American Association of Orthodontists and all of its members. The action charges that the group has exerted pressure on commercial suppliers of equipment and on dental trade publications for the purpose of promoting orthodontists' financial interests.

Twenty-five of the Association's officers, directors and members are named as respondents, but the complaint makes it clear that all members—of which there are approximately 1,195, according to the FTC—are parties in the case. Most of them are engaged in interstate commerce, says the complaint.

The government agency's allegations are that orthodontists have tried to prevent competitors from having free access to media of advertising; acted to block access to such media by sellers of supplies and equipment used by dentists and dental laboratories; induced publishers and editors of trade publications not to solicit or publish advertisements by non-members of the American Association of Orthodontists, and that they "used respondent Association as an instrumentality or medium for carrying on and making effective their aforesaid combination."

A hearing on the complaint before a Federal Trade Commission examiner is scheduled to be held in Pittsburgh on October 8.

REPORT ON U. S. DENTISTRY

Statistics on dental manpower and its distribution, specialty practice and professional education are included in "Health Resources in the United States," an informational volume published on August 11 by the Brookings Institution of Washington, a non-Federal research organization. Bulk of the figures on dentistry were supplied by American Dental Association.

The report points out that in 1950 this country had 86,876 dentists, of whom 95 per cent were in active practice. Also, that in the same year only six states licensed dental specialists; number of female dentists is declining; 1,650 Negroes are members of the profession; average age of all practicing dentists is 48 years. Tables also are provided to depict extent of fluoridation of community water supplies.

ROTATION OF RESERVES

Turnover of Reserve dental officers in military forces is now at its peak. Hundreds are being separated to inactive duty, the great majority of them being former V-12's and ASTP's who have served their obligated periods of 17 to 24 months under provisions of the so-called doctor draft law. The Department of Defense has called upon Selective Service to provide 200 more replacements in October. These are in addition to the 90 who have received September call-up orders. The Army and Air Force will divide the replacements, with the Navy still drawing upon its Reserve pool.

The Navy, besides, will "lend lease" 170 of its dental Reserves to the sister services in September and 140 more in October. This method of assigning dental officers to a different military service from the one in which they volunteered is frequently accompanied by complaints; however, Department of Defense and Selective Service officials explain that there is no alternative—that the law precludes the tapping of lower priority pools until all available members of higher priorities have been placed on active duty.

At an August meeting of the advisory committee to Selective Service, Shailer Peterson, secretary of the Council on Dental Education appeared before its members to emphasize that impending calls on dentists in Priority III will play havoc with dental faculties if extreme care is not exercised.

On August 12, less than a week after the hearing given to Dr. Peterson, representatives of American Dental Association conferred with the dental chiefs of the three armed services and Department of Defense officials on the feasibility of extending the doctor draft law (Public Law 779).

At this meeting, one of the points stressed was the relatively great vulnerability of dental school faculty members to induction—their average age is appreciably less than that of instructors in medical schools. Their induction poses a serious threat to dental education, according to Association spokesmen.

VA FEE ADJUSTMENTS

John E. Fauber, who will succeed Bion R. East as chief of dental services in the Veterans Administration on September 7, has announced approval of new contracts, adjusted upward, governing fee schedules in Illinois and Utah. As of mid-August, however, no solution had been reached with reference to the controversy that was climaxed recently when the Oregon State Dental Society canceled its contract with VA on the grounds that outpatient care fees should be increased proportionately to the rise in the cost-of-living index.

Dr. Fauber emphasized that the Utah and Illinois increases followed cost surveys conducted by the respective state dental societies, in keeping with regular policy. He disclosed that VA has approved a new schedule for another western state but withheld details pending its ratification.

DRAFT LEGISLATION AND SOCIAL SECURITY TO BE ISSUES AT ASSOCIATION'S 93rd ANNUAL SESSION

The American Dental Association's stand on Social Security coverage for dentists and on the extension of Public Law 779, the "physician-dentist draft law," will be among the issues discussed at the Association's 93rd annual session, to be held September 8-11 in St. Louis.

The question of Social Security inclusion will be brought before the House of Delegates in accordance with action taken at last year's session, when the issue was tabled for one year and its further study by dental societies was recommended.

Public Law 779, scheduled to expire July 1, 1953, affects all dentists under 51 years of age who are subject to possible call to active military duty. The law established the four priorities under which dentists and physicians may be inducted into the Armed Forces.

OTHER MAJOR ISSUES

Other significant issues to be considered at the meeting include the outpatient program of the Veterans Administration; earmarked grants-in-aid to state health departments for dental health programs; basic standards for hospital dental service, and the appointment of dentists to committees and regional offices of the Federal Civil Defense Administration.

HOTEL RESERVATIONS

A record number of requests for hotel reservations has virtually exhausted the available accommodations, it was reported recently by Henry J. Westhoff of St. Louis, chairman of the local arrangements committee. For this reason, persons who are unable to use accommodations which have already been reserved for them are asked to notify the A.D.A. Housing Bureau, Room 406, 911 Locust Street, St. Louis 1; the rooms may then be assigned to other persons.

A number of hotel suites, suitable for multiple occupancy are still available, Dr. Westhoff reports. Rooms for two to four occupants each at Washington University will also be available. The remaining accommodations will be allocated only to persons using the official housing applications blank on page A-35 of this issue of THE JOURNAL.

REFERENCE COMMITTEES NAMED

Two standing committees and nine reference committees of the House of Delegates have been appointed by LeRoy M. Ennis of Philadelphia, president of the Association. The two standing committees are:

Committee on Credentials • Paul W. Zillmann, New York; Norborne F. Muir, Virginia; Paul K. Musselman, Delaware.

Committee on Rules and Order • Timothy J. Drew, Wyoming; Homer D. Butts, Jr., Pennsylvania; John A. O'Keefe, District of Columbia.

The nine reference committees are:

Constitution and Bylaws • Harlow L. Shehan, Michigan; F. Wayne Graham, Jr., Illinois; Carl W. Maxfield, Maine.

Dental Education • E. Jeff Justis, Tennessee; Ralph E. Creig, Ohio; Lee Roy Main, Missouri.

Dental Research • Gerald D. Timmons, Pennsylvania; Melvin E. Ralston, California; Hamilton B. G. Robinson, Ohio.

Federal Dental Services • Arthur W. Kellner, Florida; Fred A. Peterson, Colorado; George W. Redpath, Oregon.

Insurance • F. A. Pierson, Nebraska; Earle D. Calkins, Wisconsin; Alfred E. Smith, Louisiana.

Legislation • Charles A. Pankow, New York; Fred J. Dingler, Washington; Donald R. Mackay, Minnesota.

Miscellaneous Business • Elmer M. Ebert, Illinois; Howard B. Higgins, South Carolina; William W. MacQueen, Minnesota.

President • Paul E. Bomberger, Pennsylvania; Walter A. Crum, Indiana; Don M. Hamm, Arkansas.

Public Health • Waldo H. Mork, New York; Frank C. Carothers, Kansas; Fred Wertheimer, Michigan.

ST. LOUIS SERVICE CLUBS TO HEAR TALKS ON DENTISTRY

Talks on dentistry will be presented at meetings of three St. Louis service clubs in conjunction with the 93rd annual session of the American Dental Association.

On September 5, Alfred E. Seyler of Detroit, director of the Children's Clinic, University of Detroit dental school, will speak at a noon meeting of the St. Louis Optimist Club. On September 11, Gerald D. Timmons of Philadelphia, dean of the Temple University dental school, will speak at the luncheon meeting of the Kiwanis Club, and James Robinson of Los Angeles, executive secretary of the Southern California State Dental Association, will address the St. Louis Rotary Club.

Arrangements for the talks were made by A. N. Blaney of St. Louis, chairman of the committee on publicity for the 1952 annual session.

ST. LOUIS FORUM TO EXPLAIN DENTISTS' DRAFT SITUATION

An open forum to explain the Armed Forces' present and future requirements relating to dental officers will be held 3-5 P.M., Tuesday, September 9, in the Gold Room of the Jefferson Hotel, St. Louis.

Speakers on the panel will include James P. Hollers, dentist member of the Armed Forces Medical Policy Council; Maj. Gen. Walter D. Love, chief of the dental division, U. S. Army; Rear Admiral Daniel W. Ryan, chief of the dental division, U. S. Navy; Col. Marvin E. Kennebeck, chief of the dental division, U. S. Air Force; Leo J. Schoeny, dentist member of the National Advisory Committee to Selective Service; Col. Richard H. Eanes, chief medical officer, Selective Service System, and two speakers yet to be selected.

The discussion will be moderated by R. H. Friedrich, chairman of the Council on Federal Dental Services. It will

Alfred E. Seyler

James Robinson

Gerald D. Timmons

be sponsored by the Special Committee on National Emergency Dental Service.

The panel speakers will be limited to a ten-minute presentation and a question period will follow. All members of the Association in attendance at the 93rd annual meeting are invited to be present.

COUNCIL ISSUES NEW BOOK ON CHILDREN'S DENTAL HEALTH

A new booklet, *Your Child's Teeth*, has been published by the Association's Council on Dental Health, to replace the booklet, *Dental Health for Young America*. The new 24-page booklet is designed for easy reading by the public and includes explanations of oral hygiene, the application of sodium fluoride, correct toothbrushing and diet. Sketches and photographs illustrate the 8½x11-inch pages.

Single copies of the booklet may be obtained without charge from the Order Department, American Dental Association, 222 East Superior Street, Chicago 11. Prices, including delivery costs, are: 25 copies, $3.85; 50 copies, $6.70, and 100 copies, $11.50.

LIBRARY RECEIVES MICROFILM OF EARLY DENTAL MANUSCRIPT

The microfilm of a manuscript of the first dental textbook, dating from the early eighteenth century, has been presented to the Association library by the Fédération Dentaire Nationale of France. This valuable manuscript was used as a printer's copy of *Chirurgien Dentiste (The Surgeon Dentist)*, written by Pierre Fauchard and published in 1728. The original manuscript has never before been photographically reproduced for study by historians.

The library also received as a gift from the private library of Maurice Brenot of Paris a copy of the first edition of Fauchard's book in two volumes, dated 1728. These gifts were presented by Jean Deliberos, president of the Fédération Dentaire Nationale, to Harold Hillenbrand, secretary of the Association, at the banquet of the Fédération Dentaire Internationale July 26 in London.

The book is significant historically as marking the beginning of the professional literature of dentistry. The manuscript is thought to furnish the key to controversial problems regarding the authorship and composition of Fauchard's book.

NEW HEALTH AND ACCIDENT POLICY NOW AVAILABLE

During September, all members of the American Dental Association will receive an announcement giving complete details of the new health and accident insurance policy now available to them. This plan for informing members of the insurance was announced recently by Paul W. Zillmann of Buffalo, chairman of the Council on Insurance.

Effective September 1, a two-months' enrollment period will begin, during which dentists may apply for inclusion into the policy. Dr. Zillmann emphasized that the new insurance, as approved by the Board of Trustees, is not intended to conflict with insurance plans available through constituent and component societies.

"It is not the intention to suggest the discontinuance of existing accident and health plans in any state or local dental society but rather to consider the American Dental Association policy as a basic plan to supplement other coverages already in force," he stated.

The policy defines total disability as the inability to practice dentistry and provides payments up to $400 a month for such disability. The insurance was described in a report by the Council on Insurance on pages 44-45 in the July issue of THE JOURNAL.

International

INTERNATIONAL DENTAL CONGRESS ATTRACTS 500 A.D.A. MEMBERS; FÉDÉRATION DENTAIRE INTERNATIONALE ELECTS O. A. OLIVER

More than 1,000 visitors from the United States were in attendance at the XIth International Dental Congress which was held in London, July 19-26. Unofficial estimates indicate that approximately 500 dentists from the United States participated in what was generally considered by those present as the most successful Congress in recent history.

The Congress, which is held every five years under the auspices of the Fédération Dentaire Internationale, was held in the Royal Festival Hall, scene of the 1951 Festival of Britain. On July 19, in the presence of ambassadors from more than 50 countries, the Congress was opened by the Hon. Iain Macleod, British Minister of Health, and E. Wilfred Fish, president of the Congress.

For the succeeding three days, the Royal Festival Hall was the scene of an elaborate scientific program which had been arranged under the direction of W. Stewart Ross, chairman of the scientific commission.

Twenty-four members of the American Dental Association participated as essayists, discussers or symposium speakers; 74 gave table demonstrations, 24 presented scientific exhibits and 29 showed films. During the Congress the British Dental Association conferred honorary membership on Russell W. Bunting of Ann Arbor, Mich.; William N. Hodgkin of Warrenton, Va.; Andrew F. Jackson of Philadelphia, and Oren A. Oliver of Nashville, Tenn. An honorary degree of Fellow in Dental Surgery was awarded by the Royal College of Surgeons to LeRoy M. Ennis of Philadelphia, president of the American Dental Association.

One of the features of the Congress was the Dental Health Exhibition which was opened to the public July 19 by Miss Pat Hornsby Smith, M.P., Parliamentary Secretary, Ministry of Health. The Exhibition gave prominence to a display on fluoridation prepared by the Council on Dental Health of the American Dental Association.

The Congress presented a brilliant array of social events, including receptions by Her Majesty's Government, by the British Dental Association, the Royal Society of Medicine and the London County Council. The Congress Ball in Royal Albert Hall and the Congress Banquet in the Grosvenor House Hotel were attended in large numbers.

Oren A. Oliver (above) of Nashville, Tenn., was elected to the presidency of the Fédération Dentaire Internationale at the recent International Dental Congress in London. Dr. Oliver, a former president of the American Dental Association, is a member of the Association's Council on International Relations.

British Minister of Health Iain Macleod addresses the XIth International Dental Congress in opening ceremonies July 19 at the Royal Festival Hall, London. Seated behind the speaker to the left, is Gerald H. Leatherman, Honorary Secretary of the Congress, and to the right, are E. Wilfred Fish, President of the Congress, and C. F. L. Nord, President of the Fédération Dentaire Internationale.

Shown at the Congress Banquet are (l. to r.) Harold Hillenbrand, American Dental Association; Don W. Gullett, Canadian Dental Association; Herbert Parker Buchanan, and A. E. Rowlett, British Dental Association.

Cross-section of the audience at a scientific meeting, showing the earphones through which immediate translations could be heard.

A view of the London County Council's reception of the International Dental Congress presents a striking panorama of the bank of the Thames River, showing the Houses of Parliament. Other receptions were accorded the Congress by Her Majesty's Government, the British Dental Association and the Royal Society of Medicine.

Oren Oliver of Nashville, Tenn., later elected to the presidency of the Fédération Dentaire Internationale, receives an honorary membership in the British Dental Association from the organization's president, H. T. Roper-Hall. Others who received memberships were Russell W. Bunting of Ann Arbor, Mich.; William N. Hodgkin of Warrenton, Va., and Andrew F. Jackson of Philadelphia.

Arrangements for the Congress were splendidly made under the direction of Gerald H. Leatherman, Honorary Secretary of the Congress, and members of a largely volunteer staff.

F.D.I. ELECTS OREN OLIVER

Following the Congress, the Fédération Dentaire Internationale held a short business meeting at which officers were elected. The following is the new roster of officers:

Oren A. Oliver, U.S.A., president; C. F. L. Nord, Holland, immediate past president; Jean Deliberos, France, vice-president; H. Hillenbrand, U.S.A., vice-president; Albert Joachim, Belgium, vice-president; Daniel F. Lynch, U.S.A., vice-president; Olaf Grythe, Norway, vice-president.

W. Stewart Ross, Great Britain, chairman of the council; Professor H. H. Stones, Great Britain, editor of the *International Dental Journal;* J. Stork, Holland, treasurer; G. H. Leatherman, Great Britain, Secretary General; Knut Gard, Norway; Thure Brandrup-Wognsen, Sweden, and L. Solas, France, members of the council.

Since its postwar reorganization meeting in Boston in 1947, the governing statutes of the F.D.I. have been under revision. New statutes were adopted at the London meeting. The dental associations of Germany and Japan were readmitted to membership in the F.D.I.

The next annual session of the Fédération will be held in Oslo, Norway, probably during the months of June or July, 1953. The next quinquennial Congress will be held at Rome in 1957.

Harold Hillenbrand (left), secretary of the American Dental Association, signs the roll of recipients of honorary degrees at the National University of Ireland, after being awarded the honorary degree Master of Dental Surgery.

Eamon de Valera (right), Prime Minister of Eire and chancellor of the National University, conferred the degree in ceremonies held July 8 at Dublin.

DENTISTRY IN GERMANY RESTRICTED TO A PROFESSION

The German Republic has restricted the practice of dentistry to professionally trained persons, through a new law which one German correspondent terms, "a solution which creates a clear road for the development of scientific dentistry."

The new law attacks the problem of Germany's "dentists without approbation," a group of craftsmen who have had the right to practice dentistry through a law passed in 1869. While the currently active "dentists without approbation" will be accepted legally, their trade schools will be discontinued and no succeeding craftsmen will be permitted to practice dentistry.

The activities of German dental laboratory technicians have also been limited by the new law, which restricts them to the manufacture of dental prostheses.

"With the conquest of the dualism in the field of dentistry . . . scientific dentistry has emerged victorious," writes a member of the Association of the Representatives of the German Dental Profession.

PAN-AMERICAN DEANS FORM PERMANENT POLICY BOARD

The Board of Deans of America, founded during the first Dental Congress of Pan-American Universities (C.U.P.O.) in May, has announced the election of Guillermo A. Bizzozero of Buenos Aires to the presidency of the Board.

Gerald D. Timmons, dean of the Temple University dental school, represents deans of United States dental schools on the 21-member Board.

The first resolutions adopted by the board are concerned with the unification of the curriculum in Latin American dental schools, the adoption of a five-year minimum curriculum, the organization of a second Congress and the establishment of a Pan-American Federation of Colleges and Schools of Dentistry.

The Board will meet in January at Mexico City to organize the second Congress and to plan the execution of its resolutions.

SWISS DENTAL SOCIETY RECOMMENDS FLUORIDATION

A recommendation that Swiss cities fluoridate their water supplies was passed at the 1952 meeting of the Swiss Odontological Society. Wording of the resolution approving fluoridation follows:

"The general assembly of the Swiss Odontological Society . . . recognizes the positive results observed in Switzerland as well as in foreign countries regarding the prophylactic action on dental caries exerted by fluoridated water under controlled conditions.

"It considers that the responsible authorities of public health should, from now on, undertake the study of practical measures in the field of artificial fluoridation of drinking water.

"The technic of fluoridation of water should be undertaken in each particular region, with reference to local conditions."

CANADIAN DENTAL ASSOCIATION ELECTS GUSTAVE RATTÉ

The new president of the Canadian Dental Association is Gustave Ratté of Quebec, who has served on the C.D.A. Board of Governors for six years and on its executive committee for several years. Dr. Ratté was installed as president during the recent Golden Jubilee Meeting of the Canadian Dental Association at Vancouver, B.C.

During the meeting, two eminent Canadian dentists were presented honorary memberships in the C.D.A. They are R. L. Pallen of Vancouver, registrar

of the College of Dental Surgeons of British Columbia, and M. H. Garvin of Winnipeg, founder and editor of the *Journal of the Canadian Dental Association.*

FAMOUS HISTORIAN TO SELL RARE DENTAL SPECIMENS

The rare collection of ancient prosthetic specimens owned by Vincenzo Guerini of Naples, Italy, has been offered for sale. Some of the gold bridges and other appliances are from ancient Etruscan and Roman times, probably from the fifth century B.C.

Dr. Guerini, who is famous for his *History of Dentistry,* has been induced to part with his collection because of lack of funds; he is 92 years old, blind and almost entirely deaf. The price placed on his collection of specimens is $2,000.

Dr. Guerini's *History of Dentistry,* covering the earliest times to the end of the eighteenth century, was published in English in 1909 by the National Dental Association, as the American Dental Association was then named.

Dental Societies

DENTAL SOCIETIES URGED TO PARTICIPATE IN HEARINGS

The President's Commission on the Health Needs of the Nation, which is now conducting one-day public hearings in eight major cities, has requested the cooperation of dental societies in these regions.

Constituent and component societies were requested to attend and participate in the regional hearings, which are designed, the Commission stated, to obtain "a broad representation of opinion from medical, labor, farm, consumer, educational, health and other groups on the vital health problems facing each region where we hold hearings."

The representatives of such organizations are given an opportunity to present a ten-minute oral statement on the adequacy of local health personnel, public health units, research, hospital facilities, health insurance plans and other matters. A formal statement must be filed with the Commission.

Three hearings have been held: Philadelphia, August 11; Dallas, August 18, and Raleigh, N.C., August 25. The five additional hearings include: Minneapolis, September 2; St. Louis, September 15; Cleveland, September 22; Detroit, September 23, and San Francisco, September 29.

At the initial public hearing, August 11 in Philadelphia, three prominent spokesmen for dentistry presented their views before the President's Commission. Frederick Herbine of Reading, Pa., president of the Pennsylvania State Dental Society, urged increased emphasis on dental health education, on dentistry for children and on fluoridation of public water supplies. John Looby, president of the Philadelphia County Dental Society, and J. L. T. Appleton, chairman of the Health and Welfare Council of Philadelphia, spoke on local dental health problems.

In a letter suggesting that dental societies participate in these hearings, the Association's Bureau of Public Information stated: "These hearings should provide a good opportunity for dental societies to present accurate information on dental health problems in their areas to the Commission and at the same time call to the attention of the general public the recommended programs of the dental profession."

OREGON DENTAL SOCIETY CANCELS VA CONTRACT

The Oregon State Dental Society has canceled its contract with the Veterans Administration after objecting to the prevailing VA fee schedules for outpatient services. The Oregon dentists seek a contract with fee raises based on rises in the cost-of-living index.

In mid-August increases were approved for Illinois and Utah after hearings in which both constituent dental societies presented strong cases. Increases have previously been granted to dentists in Maine, Nebraska, South Carolina and Puerto Rico.

F. S. MC KAY TO RECEIVE HENRY SPENADEL AWARD

The Henry Spenadel Award of the First District Dental Society of New York will be presented to Frederick S. McKay of Colorado Springs at a meeting October 6, it has been announced by Isidore Teich, chairman of the Award committee. The Henry Spenadel Award is given annually for "distinguished and significant contributions to dentistry."

The citation accompanying the award takes note of Dr. McKay's pioneer investigation of dental fluorosis and his subsequent studies on the use of fluorides in drinking water to inhibit caries.

Dental Education

F. J. CONLEY TAKES NEW POST AT SOUTHERN CALIFORNIA

Francis J. Conley, director of the postgraduate division of the University of Southern California dental school since 1949, has been appointed director of clinics at the school. He will have the rank of professor of clinical dentistry, it

Francis J. Conley

was announced by Robert W. McNulty, dean of the dental school.

A past president of the Southern California State Dental Association, Dr. Conley has been in private practice since his graduation from the dental school in 1931. In his new post he will supervise the clinic work of 200 advanced students.

RESEARCH ASSISTANTS COURSE CONTINUED AT PENNSYLVANIA

The University of Pennsylvania dental school has announced that it is continuing this year its program for the training of technicians in the preparation of oral and dental tissues for histological examination. This is a one-year course, supervised by the department of pathology; it is open annually to four applicants, who are placed after graduation in the research departments of various dental laboratories and institutions.

Further information on entrance requirements and on obtaining graduates for employment in research, may be obtained by writing to The Thomas W. Evans Museum and Dental Institute, 4001 Spruce Street, Philadelphia 4.

NATIONAL ORGANIZATIONS TO MEET IN MARCH

The 1953 meetings of the International Association for Dental Research and the American Association of Dental Schools will be held during March at the Ben

Franklin Hotel, Philadelphia, it was recently announced.

The International Association for Dental Research will meet March 20-22; further information may be obtained from Edward H. Hatton, secretary, 2419 Simpson Street, Evanston, Ill. The American Association of Dental Schools will meet March 23-25; details of the program may be obtained by writing to Marion W. McCrea, secretary, 42 South Green Street, Baltimore.

OFFER TRAINING COURSE FOR LABORATORY TECHNICIANS

Applications are now being accepted for a two-year course in dental laboratory technician's training, to be offered by the University of California Extension, Los Angeles. Applicants must have the equivalent of a high school diploma and must pass a test designed to measure the mechanical aptitudes which are needed for this craft.

The course will begin October 15; interested persons have been advised to write promptly for further information and application forms. Inquiries may be addressed to James R. Bell, University of California Extension, 815 South Hill Street, Los Angeles 14.

POSTGRADUATE COURSES OFFERED BY DENTAL SCHOOLS

Indiana • A postgraduate refresher course in dentistry for children will be presented by Indiana University School of Dentistry as a series of weekly lectures and clinical demonstrations to be held on Thursday afternoons, October 16-November 20.

The course is designed to emphasize the clinical application of the recent advancements in pedodontic diagnosis, pulp therapy, management of traumatic injuries and prevention of dental caries. Enrollment is limited. Application forms may be obtained by writing to the dean, Indiana University, School of Dentistry, 1121 West Michigan Street, Indianapolis.

Washington • Practical root canal therapy will be the subject of a five-day course to be presented September 22-26 by the University of Washington dental school, Seattle. Lectures and clinical demonstrations will be presented under the direction of John I. Ingle and Milan V. Starks, members of the school's endodontics department.

Although enrollment will be limited to 20 participants, the course will be repeated if applications warrant. Further information and application forms may be obtained from the director of postgraduate dental education, School of Dentistry, University of Washington, Seattle 5.

NEW JERSEY LICENSURE BOARD ANNOUNCES EXAMINATIONS

Examinations for licensure in the State of New Jersey will be conducted by the State Board of Registration and Examination in Dentistry, December 8-12. The clinical examinations will be held December 8 and 9 at Temple University, Philadelphia. Written examinations will be held December 10-12 at Trenton.

Request for application should be sent to W. A. Wilson, secretary, 150 East State Street, Trenton 8, N. J. The preliminary application, together with a fee of $50, must be filed 60 days prior to the examination.

The four-section plan of examination which was introduced by the Board in June, will be administered. It consists of: clinical prosthetic dentistry, clinical operative dentistry, oral diagnosis and treatment planning, and written examinations. If a candidate fails any one of the four sections, he may take two reexaminations in the sections failed, within a period of three years.

National Defense

PRIORITY III REGISTRANTS OVER 35 TO BE CLASSIFIED

The immediate draft classification of Priority III dentists over 35 years of age has been ordered by the Selective Service System, as the Army and Air Force called for the induction of 200 dentists in October, in addition to the 90 dentists to be called this month.

Priority III registrants are dentists under 51 with no military service since September 16, 1940. They will be selected for induction according to age, with the youngest being inducted first. These will include new graduates of dental schools who have had no previous military service.

The recently-ordered classification of Priority III dentists under 35 years of age will fail to produce a sufficient number of inductees to meet military needs, a Selective Service directive indicated.

Meanwhile, the Selective Service System announced that, as of June 1, 12 dentists had been inducted as enlisted men, after refusing to apply for commissions.

ARMY DENTISTS IN KOREA ORGANIZE DENTAL SOCIETY

The Seoul Area Dental Society has been organized by dental officers of the Eighth Army in Korea, "to acquaint members with the latest technical knowledge and skills in dentistry," according to an announcement from Capt. John E. Lombardi, president.

Captain Lombardi, a graduate of Marquette University dental school, comments that the Society's monthly meetings will be held at various places in Korea, and will feature lectures and clinical demonstrations by specialists in the several fields of dentistry. Lieut. Thomas A. Byas, a graduate of Howard University dental school, is secretary-treasurer of the Society.

R. W. TAYLOR TO COMMAND NAVAL DENTAL SCHOOL

Capt. Ralph William Taylor, DC, USN, recently assumed command of the Naval Dental School at the National Naval Medical Center, Bethesda, Md., relieving Capt. L. D. Mitchell.

Capt. R. W. Taylor, DC, USN

A diplomate of the American Board of Oral Surgery, Captain Taylor was graduated from the University of Southern California dental school and served as a clinical instructor at the school before entering the Navy Dental Corps in 1928. During World War II Captain Taylor served as senior dental officer aboard the *USS Yorktown*, which received the Presidential Unit Citation for outstanding and heroic achievements.

NEW DENTISTS REMINDED TO REGISTER UNDER PL 779

All 1951 and 1952 graduates of dental schools have been urgently requested by the National Advisory Committee to the Selective Service System to register immediately with their local draft boards under the provisions of Public Law 779.

Graduates who have not registered as special registrants are subject to investigation by the Federal Bureau of Investigation and are liable to prosecution by the Department of Justice.

Previous registration under the general Selective Service laws, they warned, does not exempt male dentists under the age of 50 from registration under PL 779, nor does the fact that a dentist is deferred as a regular registrant, nor that he has had previous military service. The only male dentists not liable for registration under Public Law 779 are those who are currently members of Army, Navy and Air Force Reserve components.

The National Advisory Committee announced that its State Advisory Committee plans to check with State Boards of Dental Examiners to obtain the lists of all dentists granted licenses within the past two years. These will be checked against Public Law 779 registration lists to discover those dentists who are not registered in accordance with the law.

In its statement the National Advisory Committee pointed out that failure to register on the part of many 1951 and 1952 graduates in dentistry has probably resulted from lack of understanding that they were required to register under both the general Selective Service System law and Public Law 779. Such failure, they stated, is a specific violation of the Selective Service law.

NAVY RESERVE DENTISTS CALLED FOR ARMY SERVICE

Naval Reserve dentists whose length of service corresponds to Priority II draft registrants—more than three months but less than 21—are now being called to active duty for assignment to Army and Air Force dental units.

During August, 130 of these Reserves were called by the Navy and "borrowed" by the Army; in September the Navy plans to call 170 more Reserves and assign them to Army and Air Force units. This system of assignments is designed to deplete the pool of Priority II type Reserves before Priority III dentists are called, it has been announced.

Navy Reserve dentists who are liable for call may request immediate active duty orders in the Navy if they wish to assure their service in that branch.

Public Health

USPHS AWARDS CANCER GRANTS TO 11 DENTAL SCHOOLS

Eleven dental schools recently were awarded grants totaling $53,953 from the U. S. Public Health Service for the support of training programs in cancer diagnosis and treatment.

The University of North Carolina dental school received a $5,000 grant for the establishment of a new cancer teaching program; the other grants provide for the continuation of previously supported projects at the dental schools of the University of California, Northwestern University, University of Maryland, University of Michigan, University of Detroit, University of Minnesota, University of Kansas City, St. Louis University, Creighton University and the Medical College of Virginia.

JAMES R. CAMERON NAMED TO HOSPITAL COMMISSION

James R. Cameron of Philadelphia, professor of oral surgery at Temple University dental school and at the University of Pennsylvania graduate school of medicine, has been appointed to represent the dental profession on the Com-

James R. Cameron

mission on Financing of Hospital Care. Dr. Cameron will fill the vacancy caused by the recent death of Ernest G. Sloman, it was announced by Gordon Gray, chairman of the Commission.

Dr. Cameron is president of the American Board of Oral Surgery and a member of the American Dental Association's Council on Dental Education. A graduate of the University of Pennsylvania dental school, he took postgraduate study both at Pennsylvania and abroad.

The Commission on Financing of Hospital Care was organized independently in November, 1951, and is composed of 34 members financed by $500,000 in grants from philanthropic foundations. It is now engaged in a two-year fact-finding program to determine solutions to the financial problems facing hospitals and those patients who are in rural, low income and chronically ill groups.

PUBLIC HEALTH DENTISTS ANNOUNCE MEETING PROGRAM

Discussions of the public health aspects of orthodontics, cleft palate restorations, federal funds for state dental services and opposition tactics to fluoridation, will highlight the meeting of the American Association of Public Health Dentists, to be held September 7 at the Hotel Lennox, St. Louis.

The morning sessions of the meeting will be devoted to business matters and an election of officers, it has been announced by Charles E. Presnell of Jefferson City, Mo., chairman of the program committee.

During the scientific program in the afternoon, John T. Fulton of Washington, D. C., will speak on "The Public Health Aspects of Orthodontics"; Woodrow O'Brien of St. Louis, on "Cleft Palate Restorations and Speech Rehabilitation"; David W. Brock of St. Louis, on "Earmarked Federal Funds for Dental Services for States," and Olin E. Hoffman of Seattle, on "Résumé of Opposition Tactics in Various Communities to Fluoridation of Public Water."

Veterans Administration

JOHN E. FAUBER APPOINTED CHIEF OF VA DENTAL SERVICE

John E. Fauber, assistant chief medical director for dental service in the Veterans Administration, will succeed Bion R. East as the VA director for dental service on September 7, when Dr. East's term expires.

The announcement of Dr. Fauber's appointment was made recently by Vice Admiral Joel T. Boone, chief medical director of the VA, who noted that Dr. East would reach the compulsory retirement age before he could complete another four-year term.

John E. Fauber

Dr. Fauber, a graduate of the University of Pennsylvania dental school, holds a master's degree in public health and hygiene from Johns Hopkins University. He served for five years in the Panama Canal Zone's health department, 12 years in the Army Dental Corps and six years on the Veterans Administration staff.

Dr. East has been asked to continue in an active advisory capacity in the Dental Service until his retirement.

Research

N.I.D.R. SCIENTIST COMPLETES LECTURE TOUR

David B. Scott, acting chief of the laboratory of functional morphology of the National Institute of Dental Research, has completed an internationally sponsored tour during which he delivered 18 lectures this summer in 11 cities of Norway, Sweden, Finland, Denmark and England. Dr. Scott lectured on studies of tooth structure being conducted at the Institute with the electron microscope.

Dr. Scott's trip was sponsored by dental societies and schools in the five countries.

IRL SCHOONOVER TO DIRECT NEW N.B.S. SECTION

Irl C. Schoonover, assistant chief of the organic and fibrous materials division of the National Bureau of Standards, has been appointed chief of the division's newly-organized polymer structure section. Dr. Schoonover is known internationally for his direction of the research program on dental materials being conducted at the National Bureau of Standards in cooperation with the American Dental Association, the Department of Defense and the Veterans Administration Dental Service.

General

FTC CHARGES ORTHODONTISTS WITH RESTRAINT OF TRADE

The Federal Trade Commission has instituted proceedings against the American Association of Orthodontists, charging that the organization has engaged in unfair business practices which "have a dangerous tendency unduly to hinder competition and create . . . a monopoly in the manufacture and sale of orthodontic equipment, supplies and devices."

In its first action against a professional group, the Federal Trade Commission charges that the organization:

"1. Acted to prevent competitors from having free access to media of advertising serving the dental profession.

"2. Acted to prevent sellers of supplies and equipment used by dentists and dental laboratories from having access to media of advertising serving the dental profession.

"3. Acted to coerce and compel, by various means, publishers and editors of trade publications in the dental and orthodontic field from soliciting or publishing advertisements from non-members of said respondent Association.

"4. Used respondent Association as an instrumentality or medium for carrying on and making effective their aforesaid combination."

Respondents have 20 days to file their answer to these charges. The complaint named 25 respondents as leaders and representatives of the 1,195 members of the American Association of Orthodontists. The hearing on the complaint will open October 8 in Pittsburgh before an examiner of the FTC.

STATE LABORATORY GROUPS TO MEET AT N.A.D.L. SESSION

Forty state dental laboratory associations will be represented at the second session of the House of Delegates of the National Association of Dental Laboratories, to be held October 3-5 in Kansas City, Mo.

A guest speaker at the meeting will be Frederick Herbine of Reading, Pa., chairman of the American Dental Association's Council on Dental Trade and Laboratory Relations.

INTERNATIONAL COMMITTEE TO REVISE ANATOMICAL TERMS

An international committee sponsored by the Council for the Coordination of International Congress of Medical Societies (UNESCO), has agreed to revise and bring up to date the Basel Anatomical Nomenclature, the universally accepted BNA.

The committee will appoint subcommittees to prepare necessary changes in the anatomical terminology for each system of organs of the body. The revisions will be submitted to the next International Congress of Anatomy, meeting August 1955 in France.

Oral anatomists desiring further information may address inquiries to George W. Corner, Carnegie Embryological Laboratory, Wolfe and Madison Streets, Baltimore 5.

WEST COAST DENTAL SEMINAR TO HEAR SIX SCIENTISTS

Six lecturers have been announced as participants in the ninth annual Seminar for the Study and Practice of Dental Medicine, which will be conducted October 26-30 at the Desert Inn, Palm Springs, Calif.

The lecturers are: Hermann Becks, chairman of the division of dental medicine, University of California dental school; Herbert Evans, professor of anatomy and biology at the University of California; William Rettberg, assistant clinical professor of medicine, University of Colorado; Ralph Raynolds, physician and author of scientific articles; Harry Sicher, professor of anatomy, histology and research at Loyola University dental school (Chicago), and William Ward Wainwright, professor of radiology of the University of Illinois dental school.

Inquiries may be addressed to Miss Marion G. Lewis, executive secretary, Room 200, Hooper Foundation, University of California Medical Center, San Francisco 22.

FORMER ASSOCIATION OFFICER FRED R. ADAMS DIES

Fred R. Adams of Brooklyn, vice-president of the Association in 1935-36, died recently at the age of 80. A former chairman of the Relief Commission, forerunner of the Council on Relief, Dr. Adams had practiced dentistry in New York for 54 years. He was a graduate of the Pennsylvania College of Dental Surgery, class of 1894.

ORAL SURGEON TO SPEAK ON INHALATION ANESTHESIA

The use of inhalation anesthesia in the treatment of ambulatory patients will be discussed by Irwin Langel of New York City at the next meeting of the International Academy of Anesthesiology, October 15 at the Hotel Statler, New York City. Dr. Langel is assistant visiting dentist at Bellevue Hospital and oral surgeon at Rockaway Beach Hospital, New York.

Maurice J. Oringer, oral surgeon at Mt. Sinai Hospital, New York, will also speak. Preceding the scientific session at 8:00 P.M. in Parlor B, a pre-meeting dinner will be held at 6:30 P.M. in Parlor A. Information on the program and on

membership in the International Academy of Anesthesiology may be obtained from Irwin G. Tomack, 355 East 149th Street, New York 55.

ACADEMY OF DENTAL MEDICINE TO HEAR SYMPOSIUM ON PAIN

A symposium on pain will be featured at the next meeting of the American Academy of Dental Medicine, to be held December 7, in the Hotel Statler, New York. Participants in the symposium will be R. J. Behan of Pittsburgh, Theodor Blum and Samuel C. Miller of New York; moderator will be Joseph L. Bernier of Washington, D. C. The discussion will be conducted 2-5 P.M. following a business meeting for members at 10:30 A.M. and a luncheon at 12:30 P.M.

All interested dentists are invited to the luncheon and symposium. Reservations may be obtained by writing to William M. Greenhut, secretary, 124 East 84th Street, N. Y.

LOYOLA ALUMNI BREAKFAST WEDNESDAY, SEPTEMBER 10

The alumni of Loyola University School of Dentistry, Chicago College of Dental Surgery, will hold a breakfast meeting in the Crystal Room of the Jefferson Hotel, St. Louis, at 8 A.M. on Wednesday, September 10.

All alumni of the school are invited to attend. For additional information write to Joseph F. Porto, president, 25 East Washington Boulevard, Chicago.

OFFICERS OF AMERICAN BOARD OF ORTHODONTICS LISTED

Current officers of the American Board of Orthodontics, previously listed incorrectly, are as follows: Leuman M. Waugh of New York City, president; Raymond L. Webster of Providence, R.I., vice-president; Lowrie J. Porter of New York City, treasurer, and C. Edward Martinek of Detroit, secretary. Directors of the board include Ernest L. Johnson of San Francisco; William E. Flesher of Oklahoma City, and Max E. Ernest of St. Paul, Minn.

MARYLAND SEEKS DENTISTS FOR STATE MENTAL HOSPITAL

The State of Maryland has announced openings for dentists in its Springfield State Mental Hospital. The applicants for the position must have had one year of experience as a dentist and must possess a Maryland license or be eligible for the license.

Further information may be obtained from Russell S. Davis, Maryland State Employment Commissioner, 31 Light Street, Baltimore 2.

DENTAL GUIDANCE COUNCIL FOR CEREBRAL PALSY TO MEET

A report on the cerebral palsy dental program at Columbia University's dental school will be presented by the program director, Solomon N. Rosenstein, at the annual meeting of the Dental Guidance Council for Cerebral Palsy, October 30 at the Midston House, 38th Street and Madison Avenue, New York.

Another paper, entitled "Cerebral Palsy: Etiology and Therapy," will be presented by Stanley S. Lamm, clinical professor of pediatrics at the New York State University Medical School and director of the cerebral palsy clinic at Long Island College Hospital.

Interested members of the dental profession may attend the meeting and a pre-meeting dinner to be held at the Midston House at 6:30 p.m. Dinner reservations may be made at the offices of the Dental Guidance Council for Cerebral Palsy, 48 West 57th Street, New York 19.

Book Reviews

SPECIAL OR DENTAL ANATOMY AND PHYSIOLOGY AND DENTAL HISTOLOGY

By T. W. Widdowson. Eighth edition. 481 pages with 360 illustrations, 10 in color. Index. Price $10. New York, Staples Press, 1952.

Forty-five years have elapsed since the first edition of this book appeared. During that period an increased amount of accurate research work has been conducted, and many of the views originally presented in this volume have been discounted and superseded by newer concepts. In this edition the author, an English dentist, has omitted much that is theory or that is not acceptable to the majority of present-day authorities. New knowledge on calcification (more particularly of the hard dental tissues), eruption of the teeth and resorption of the deciduous teeth is more fully described. A number of illustrations which appeared in the seventh edition have been excluded, and more appropriate ones are included. A number of references appear in the text. Included in the text is a chapter on histological technic by Leslie Young, also of England.

The book is written in a scholarly, pedantic manner, the subject matter being presented in a way that stimulates one's interest. The illustrations and charts help to clarify and enliven the text. This work is recommended to the practicing dentist whose desire for knowledge and understanding transcends the ordinary dental knowledge, and to the student who desires a better grounding in the basic sciences.

E. Alan Lisban

THE MEDICAL WORKS OF HIPPOCRATES

By John Chadwick and W. N. Mann. First edition. 301 pages. Index. Price $5.50. Springfield, Ill., Charles C Thomas, 1950.

Providing some material for the first time in an English translation, this scholarly collaboration demonstrates that on occasion old wine can be put into new bottles with benefit to the consumer.

As the authors point out, during the last century, in which the greatest advances in medical learning have occurred since Greek days, the works of Hippocrates have been less known that at any other time. It is safe to surmise that a thoughtful review of the basic principles of the healing art was never more appropriate than now.

Exercising careful selection, the authors have succeeded in bringing together a presentation of Hippocrates' work that excludes dubious passages and just as carefully avoids too free translation or incorporation of the translator's idea of what may have been meant. Among chapters of special interest are: two presenting aphorisms, one attacking the idea that epilepsy should be considered a "sacred" disease—and containing a consideration of diagnosis and treatment that is virtually modern—a discussion of dreams, the popular Hippocratic lecture on physiology titled The Nature of Man, and the doctrine of preventive medicine expounded in "a regimen for health."

The Hippocratic oath is reproduced, as is the Canon, a brief note on the characteristics desirable in a student of the healing arts. In addition to an extensive general index, there is a special index of diseases and conditions to which passages in the text evidently, or at least probably, refer, even though they are not mentioned by name. The book is a valuable library item for every student and worker in the health sciences.

Wm. W. Bolton

UNDERSTANDING HEREDITY—AN INTRODUCTION TO GENETICS

By Richard B. Goldschmidt. First edition. 228 pages. Glossary and Index. Price $3.75. New York, John Wiley & Sons, Inc., 1952.

Professor Goldschmidt, one of the world's foremost geneticists, has written this compact genetics "primer" that can be read, understood and enjoyed by those without a scientific background. It will stimulate those who wish to solve the basic riddle of why they are what they are, and to differentiate between what is and what is not inherited.

The text's broad coverage and concise definitions present a thorough consideration of genetic theories, from which it becomes clear that the simple statements made on the subject in the past are misleading.

The following topics are discussed: Chapter 1. Hereditary and Non-Hereditary Traits, 2.

The Sex Cells and Fertilization, 3. Elementary Mendelism, 4. More Elementary Mendelism, 5. Chromosomes and Mendelism, 6. Linkage, 7. Mutation, 8. Sex Chromosomes and Sex-Linked Inheritance, 9. Collaboration of Genes, 10. Summative or Multiple Factors, 11. Multiple Alleles, 12. A Glimpse of More Technical Facts and Problems of Genetics.

The volume covers a wide latitude of subjects as far as the scientfic aspects and views are concerned and, therefore, can be recommended to those who seek information regarding the interesting study of heredity.

In addition to being a fundamental contribution, this book is to be commended for its readable style, good glossary, index, neat format and attractive binding.

E. Alan Lieban

FOOD AND YOU

By Edmund S. Nasset. 92 pages. Index. No price listed. Springfield, Ill., Charles C Thomas, 1951.

This book was written by Edmund Nasset first for his daughters and now for the public, in the hope that it would help to develop an enlightened attitude toward the problems of nutrition.

In general, the discussions are in nontechnical language. The simplified statements, however, may cause lay people to misunderstand some important dietary facts. Caution is required when writing for those without technical training; one who knows a great deal about a subject may read into his statement more than he has said. There are a number of statements in the book open to this criticism.

One example is in the chapter on common sense about food. This is an italicized statement on page 85: "The average healthy person's nutritional needs will be satisfied if he eats at least one serving from each of the seven basic food groups every day." Actually, if persons followed this rule exactly, they would almost never satisfy their needs for essential nutrients.

The author knows what he means by the "size of servings" which would supply these essential nutrients, whereas the lay person thinks in terms of single food servings at a meal. These customary servings are too small to provide the required amounts of essential nutrients daily. The author was stressing the importance of variety in obtaining a well-balanced diet and perhaps the value of following a daily food pattern, but he oversimplified his statement.

Dr. Nasset convinces his readers that good nutrition is not achieved by chance, but he fails to give a sufficiently clear pattern for the individual to follow. This book thus serves best as an explanatory supplement on composition of foods, digestion and absorption for the lay person who has been instructed in a specific daily dietary plan.

Dorothea F. Radusch

INTRODUCTION TO MODERN CHEMISTRY

By P. C. Gaines, L. O. Binder, Jr., and Ray Woodriff. First edition. 576 pages with 92 figures and 52 tables. Index. Price $4.75. St. Louis, C. V. Mosby Co., 1951.

In the preface of this excellent text, the authors state that this book was written with a view to omitting material which belongs in an advanced course. This objective has been achieved nicely; yet the whole field of chemistry is covered in such a masterly fashion as to make the book appear to verge on the threshold of advanced chemistry.

Of particular interest is the periodic chart just inside the front cover, which presents information far in excess of the periodic order of the elements. The section on weights, units, measures and, to some extent, terms, is presented in a clear, concise fashion. Considerable space is devoted to this section, but perhaps this is necessary, as all too frequently students approach their second or third year of college science with limited scientific vocabularies and little understanding of measures.

Chemical reactions, especially those involving covalency and electron transfer, are presented in an unusually clear fashion.

Introduction of the term "ato" is welcome, if for no other reason than to focus attention on the need for a suitable term to represent this concept. One cannot but wonder if there is not a more suitable term, since many expressions already existent can be confused with this one.

The vast majority of plates and figures are clear and lucid; however, illustrations such as Figure 56 are almost meaningless and certainly not of the same caliber as the others. It is possible that this sort of illustration results from poor printing rather than poor selection.

The value of this book is enhanced by the introduction of the latest topics in chemistry, such as the silicone compounds, food chemicals, detergents and breeder piles. Truly, this book presents a wide, clear introduction to the chemistry of today.

B. F. Gurney

Current Literature

JOURNAL OF DENTAL RESEARCH
June 1952

ORAL SENSORY THRESHOLDS OF PERSONS WITH NATURAL AND ARTIFICIAL DENTITIONS

R. S. Manly, Carl Pfaffman, Donald D. Lathrop and Joan Keyser, p. 305.

Judgment of thickness tested with disks held between anterior teeth was similarly acute among denture wearers and persons with a natural dentition. The minimal threshold was 0.18 mm. Judgment of hardness tested with soft rubber disks held between the anterior teeth was similarly acute. Tested with hard rubber disks, the denture wearers were less sensitive. The tactile thresholds on biting surfaces of natural teeth ranged from an average of 1 Gm. on anterior teeth to 10 Gm. on molar teeth. The median threshold for eight denture wearers was over 125 Gm. measured at the first bicuspid position on the denture. Nine out of 10 persons with natural dentition were able to detect 2.9 per cent or less calcium carbonate in bland pudding, whereas six out of 10 denture wearers required over 9 per cent to be able to detect it.

In general it appears that the sensory discrimination of denture patients is not impaired when the forces and movements involved are of the magnitude used in mastication. When very small forces or movements are encountered, as in judgments of texture, the denture patients seem to possess a considerable handicap.

RELATION OF DENTAL CARIES EXPERIENCE AND GINGIVITIS TO GEOGRAPHIC LOCATION AND SIZE OF COMMUNITY IN MALES 17 TO 21 YEARS OLD (AT THE GREAT LAKES TRAINING CENTER)

Maury Massler and William Ludwick, p. 313.

The incidence of dental caries and gingivitis was analyzed in 2,368 young adult men 17 to 21 years of age from communities of different size in Northeastern, Central and Southern States. It was found that the men from the Southern States showed a significantly lower incidence of DMF teeth than those from the Northeast. The men from the Central States showed a caries rate almost median between the rates of the other two areas. The average frequency and degree of gingivitis were the same for persons from all three areas. The DMF and PMA rates were not significantly different for men coming from rural, suburban, city or metropolitan communities.

RELATION OF DENTAL CARIES EXPERIENCE AND GINGIVITIS TO CIGARETTE SMOKING IN MALES 17 TO 21 YEARS OLD (AT THE GREAT LAKES NAVAL TRAINING CENTER)

William Ludwick and Maury Massler, p. 319.

The relation of cigarette smoking to caries and gingivitis was investigated in 2,577 naval enlisted men 17 to 21 years of age. It was found that those who smoked more than an average of 15 cigarettes per day had a significantly greater average number of decayed, missing and filled teeth than those who smoked less than six cigarettes per day. On the other hand, the incidence of simple gingivitis was not related to the number of cigarettes smoked per day.

TESTING THE UNIFORMITY OF THE P-M-A INDEX AS A MEASUREMENT OF PERIODONTAL DISEASE

Henry C. Sandler, p. 323.

The PMA index as a measurement of periodontal disease in adults has serious defects. A test of the index demonstrated that measurements by eight dentists on examination of the same group of adult patients were widely divergent. The fact that different dentists do not agree on measurements does not preclude the use of the index by a single observer, but any comparison of observations by different dentists must be made with extreme caution.

THE EFFECT OF TOBACCO SMOKE UPON SOME BACTERIA

H. J. Turkheim, p. 326.

In vitro experiments have confirmed both the bacteriostatic and the bactericidal effect of tobacco smoke on certain organisms, these effects being more noticeable in a liquid med-

ium (water of condensation at bottom of test tube) than on solid agar. When cigar smoke was absorbed by saliva which had been washed out with saline, this "tobacco smoke-saliva-saline," filtered through a Seitz filter, mixed with sterile agar and inoculated with the test organism, proved neither bacteriostatic nor bactericidal. Colonies of *Pseudomonas pyocyanea* growing on this "tobacco-saliva-agar" observed under filtered ultraviolet rays were strongly yellow and fluorescent, whereas colonies of *Chromobacterium prodigiosum* were of a brilliant purple with a dark grey circumference.

ALKALINE PHOSPHATASE ACTIVITY OF HEALING GINGIVAL WOUNDS IN THE RAT

J. R. Ring, p. 329.

Experimental wounds in the gingiva of the rat exhibit evidence of a marked augmentation of alkaline phosphatase activity in the outer layers of epithelium adjacent to the incision and in and surrounding the organizing fibrin clot in the lamina propria. The increased enzymatic activity in the region of the healing wound appears to be associated with: (1) the growth and function of outgrowing capillaries, (2) the activity of fibroblasts in connection with the development of connective tissue fibers, (3) the activity of macrophages within and around the lesion and (4) keratinization proceeding from the margins of the epithelial cicatrix.

THE DENTAL TREATMENT NEEDS OF NAVAL PERSONNEL AS DERIVED FROM 1570 CASES

James W. Cross, p. 335.

THE EVANSTON DENTAL CARIES STUDY. IX. THE VALUE OF ROENTGENOLOGICAL VS. CLINICAL PROCEDURES FOR THE RECOGNITION OF EARLY CARIOUS LESIONS ON PROXIMAL SURFACES OF TEETH

J. R. Blayney and J. F. Greco, p. 341.

This study was conducted to determine the frequency with which carious lesions on the proximal surfaces of deciduous and permanent teeth, which were not detected by a careful clinical examination, can be detected with roentgenograms. The case records of 12,014 school children 6, 7, 8, 12, 13 and 14 years of age were reviewed to compile these data.

In the 6, 7 and 8 year old children, 69.21 per cent of the carious lesions in the proximal surfaces of the permanent teeth were recognized only by the use of roentgenograms. In the 12, 13 and 14 year old group, 61.93 per cent, not recognized clinically, were visible in the roentgenograms.

In the deciduous dentition of the younger age group, 46.14 per cent of all the proximal surface lesions were apparent only in the roentgenograms; for the older age group, 39.88 per cent of such lesions were revealed only in the roentgenograms. In these 12,014 children, a total of 64,776 proximal surface lesions was recorded. Of this total number, 34,877, or 53.84 per cent, completely overlooked during the clinical examination, were recognized with the aid of roentgen rays.

The conclusion is that it is necessary to employ both clinical and roentgenological procedures in all study programs for the determination of prevalence or for the reduction in the rate of caries.

THE EVANSTON DENTAL CARIES STUDY. X. THE CARIES EXPERIENCE RATES OF 6, 7, AND 8-YEAR-OLD CHILDREN WITH PROGRESSIVELY INCREASING PERIODS OF EXPOSURE TO ARTIFICIALLY FLUORIDATED WATER

I. N. Hill, J. R. Blayney and Walter Wolf, p. 346.

The caries experience rates of four groups of 6, 7 and 8 year old Evanston children were compared. The first, or base line group (1946), had no exposure to fluoridated water. The second (1948), third (1950) and fourth (1951) groups were exposed to the fluoridated water 12 to 22 months, 35 to 46 months, and 47 to 58 months respectively at the time of examination. The ages of the children in group four at the time of the introduction of sodium fluoride to the Evanston water ranged from 9 to 55 months. Regardless of age at the time of fluoridation, the crowns of the deciduous teeth of these children had been calcified by the time of the examination. Of the 6 year old children examined in 1951, however, only the deciduous incisor teeth had erupted when sodium fluoride was placed in the water. The differences in the deciduous dental caries experience rates for the 1951 group as compared with the 1946 base line group were not considered significant. The dental caries experience rate of the permanent teeth of the same group, however, was reduced by 46.42 per cent as compared with the base line rate in 1946. All data were evaluated by approved statistical methods.

EPIDEMIOLOGIC STUDIES IN DENTAL CARIES. V. PLACEMENT OF FILLINGS AS A SOURCE OF STATISTICAL ERROR OF ESTIMATE AS TO DENTAL CARIES PROGRESSION RATES

Julian D. Boyd, John J. Cannon and Robert E. Leighton, p. 354.

This is one of a series of reports designed to appraise the source and potential extent of error in quantitative studies on the advance of dental caries in the human subject. Specifically it deals with the increase in the number of tooth surfaces showing decay or fillings (DF) which may be observed immediately after the placement of fillings and which are due solely to the operative extension of cavities rather than to decay. Sixty per cent of the subjects showed increased caries scores attributable to placement of fillings alone; in some subjects the postoperative score was twice the preoperative score. Of those whose scores were increased, the median degree of increase was 25 per cent. Emphasis is placed on the need for consideration of the degree of dental repair, of the number and identity of carious teeth and of the posteruptive age of teeth in the selection of a group of subjects for controlled studies as well as on the need for consideration of the degree of effect which the placement of fillings during the course of a controlled study may have on the apparent course of caries in the mouths of the subjects of the study.

EFFECT OF TEMPERATURE UPON THE DEXTRINIZATION OF STARCH BY SALIVARY ENZYMES

Naomi C. Turner and George E. Crowell, p. 359.

The effect of temperature on the digestion of starch by salivary amylase was studied. Under critical test conditions the digestion of 1 per cent corn starch (insoluble) as measured with 1 per cent potassium iodide and 3 per cent hydrogen peroxide took at 50° F. 200 minutes; at 70° F. 25 minutes; at 90° F. less than 6 minutes.

A NEW TECHNIQUE FOR ORAL EXAMINATION OF RODENTS

Erling Johansen, p. 361.

A new instrument has been devised that painlessly immobilizes live, unanesthetized laboratory animals of the rodent species and keeps their mouths open. Without touching the teeth and gingiva, a complete and reliable oral examination can be performed under a dissection microscope at a magnification of 1x12. The technic for immobilization and examination of the animals is simple, quick and noninjurious when proper experience has been attained. The device consists of a right-angled metal frame with a rubber-covered aluminum plate attached to the horizontal extension. This has a small centrally placed opening into which the mandibular incisors are introduced. A lever with an attached wire loop into which the maxillary incisors are inserted is connected with the vertical extension by means of a screw and a wing nut. By moving the lever up, the jaws are separated; and when the desired level of opening is attained, the animal is locked in that particular position. The animal rests in the operator's hand during the examination.

PHYSICAL PROPERTIES OF DENTIN

F. A. Peyton, D. B. Mahler and B. Hershenov, p. 366.

The physical properties of dentin studied were modulus of elasticity, proportional limit and compressive strength. For this study, first and second molar teeth were used and hollow drills were especially designed for drilling out test samples. The average size of the specimens to be tested in compression was approximately 4.5 mm. long and 1.8 mm. in diameter. Samples were obtained from freshly extracted teeth and kept wet during the entire operation of sample preparation and until the time of the test.

Results indicate the averages of the physical properties of dentin to be: (1) modulus of elasticity: 1.67 x 10^6 psi.; (2) proportional limit, 23,400 psi.; (3) compressive strength, 36,100 psi. Test results indicate that physical properties are influenced by such variables as: (1) physiologic differences in the teeth tested, (2) directional effects in the tooth structure, (3) rate of stress application, (4) length to diameter ratio of the specimens and (5) soundness of specimens. The values obtained in this study represent useful values for the analysis of stresses and of subsequent movement in restorations and in teeth.

CRYSTALLOGRAPHIC INVESTIGATION OF TRICALCIUM PHOSPHATE HYDRATE

Aaron S. Posner and Samuel R. Stephenson, p. 371.

By the use of the hydrothermal bomb technic, crystals of tricalcium phosphate hydrate

were grown from about 500 A.U. to approximately 3 microns in length. By this means it was possible to obtain accurate crystallographic data which combined with the chemical data suggested that this substance (which is similar to bone, dentin and cementum) might be hydroxy-apatite with phosphoric acid occluded in the ratio of 0.6 moles of H_3PO_4 to one mole of $Ca_{10}(PO_4)_6(OH)_2$.

THE STAINING OF NERVE FIBERS IN TEETH

Margaret M. Powers, p. 383.

FURTHER EXPERIMENTS WITH INTACT TEETH PLACED IN VARIOUS BUFFER SOLUTIONS

Jacob Yardeni, p. 393.

Decalcification of teeth by acids manifests itself in many clinical phenomena. Experimental investigation of this process not only is of theoretical interest but also is relevant to evaluation of food habits, of the effect of soft drinks and of methods of prevention. Experiments were designed to study the dissolution rate at short intervals of time in order to approach clinical occurrence in the oral cavity.

The dissolution curve *in vitro* has a sigmoid form. The initial "lag period" is accounted for by the fact that enamel is a compact structure resistant to decalcification so that it requires time for acid diffusion to take place. The time that the acid must be in contact with the tooth to produce decalcification *in vivo* depends on many variables, such as quality of tooth structure, crystallite size, presence of organic channels for diffusion, concentration and rate of salivary flow. Enamel caps bathed in lactic acid buffer solutions of pH 3.95 for 15 minutes lose about 0.1 per cent of their weight. Such erosion if repeated may make a tooth more susceptible to bacterial attack and to decay. The gravimetric method used with air-dried specimens may lead to false determinations because of the increased imbibition of specimens through continued demineralization.

EARLY INFLUENCE OF METHYLCHOLANTHRENE ON TRANSPLANTED TOOTH GERMS: A HISTOPATHOGENIC STUDY

Harold S. Fleming, p. 398.

Tooth germs of dba mice were transplanted synchronously with several crystals of methylcholanthrene to the axillae of mice. Guinea pig tooth germs were transplanted in this same manner but to the brains of these animals. Two hundred and fifty mice in groups of 50 and 72 guinea pigs in groups of 12 to 16 received transfers as indicated above. As controls for each group, additional animals received transplants without methylcholanthrene. Animals were killed at intervals between the seventh and up to the ninetieth postoperative day. The transplants from these animals were recovered, fixed, sectioned and stained.

It was found that growth and differentiation of tooth germs were retarded in the presence of methylcholanthrene with the greatest effect seeming to be on the epithelial cells of the enamel organ. Keratin formation from both the outer and inner layers of the epithelial cells of the enamel organ was observed, and it was found that ameloblasts at certain stages of their life cycle always form keratin whether or not the pre-enamel matrix is formed. The peripheral cells of the outer enamel epithelium showed aggressive characteristics in the presence of this chemical agent. The potentiality or fate of some of the cells associated with amelogenesis seems to be altered somewhat when the development of the ameloblasts is inhibited.

THE EFFECT OF ALTERATIONS OF THE FACIAL MUSCULATURE ON THE FACIAL SKELETON AND DENTAL ARCH FORM OF THE RAT. A PRELIMINARY STUDY

Sidney L. Horowitz and Harry H. Shapiro, p. 412.

Various portions of the facial musculature were removed in one month old rats in order to determine the effects of the removal on the development of the bony architecture of the face and alveolar arches. Six different operations were performed on groups of three rats each; littermates served as controls. No significant changes were noted after sacrifice at the age of four and a half months in those animals in which the buccinator muscle (both unilateral and bilateral) had been removed, in those in which either the superior or inferior portion of the orbicularis oris muscle had been removed or in those which the orbicularis muscle had been removed unilaterally. Those animals in which the entire orbicularis oris muscle had been removed showed evidence of reduction in the dimensions of the nasal bones and in the maxillary diastema length as compared with the controls. A confirmatory study is in progress.

A RAPID RADIOAUTOGRAPHIC TECHNIQUE FOR COMBINED CALCIFIED AND SOFT TISSUES

Howard M. Myers, Elizabeth Jennings and Hermann Becks, p. 416.

A technic is described which enables ground sections (0.3 mm.) to be made from specimens containing soft and hard tissues for purposes of obtaining radioautographs. Fixing and dehydrating are accomplished with dioxane. The embedding is done with a partly polymerized plastic by means of a vacuum pump. Final polymerization occurs in 24 hours, but this time may be reduced to 15 minutes for studies with short-lived radioisotopes such as F^{18}. Orientation of the radioautograph is improved by superimposing a roentgenogram on the radioautographic image prior to developing the film.

THE COMPARATIVE EFFECTS OF PENICILLIN, BACITRACIN, CHLOROMYCETIN AUREOMYCIN, AND STREPTOMYCIN ON EXPERIMENTAL DENTAL CARIES AND ON CERTAIN ORAL BACTERIA IN THE RAT

Robert M. Stephan, Robert J. Fitzgerald, F. J. McClure, M. Rachel Harris and Harold Jordan, p. 421.

The antibiotics, penicillin, bacitracin, aureomycin, chloromycetin and streptomycin, were studied for their effectiveness in reducing experimental dental caries in the albino rat when they were added to a coarse particle diet. Penicillin at a concentration of 50,000 units per cent was most effective; the order of effectiveness for the others was bacitracin at 5,000 units per cent, aureomycin, chloromycetin and streptomycin all at 50,000 micrograms per cent. Studies of oral lactobacilli, streptococci and coliform bacilli revealed no consistent changes relatable to the caries picture.

EFFECTS OF SONIC VIBRATION ON THE NUMBERS OF MICROORGANISMS CULTIVABLE FROM HUMAN SALIVA

N. B. Williams and C. F. Eickenberg, p. 428.

A series of studies was carried out to compare the effects of mechanical shaking and sonic vibration on the numbers of cultivable microorganisms in saliva. Saliva was collected from four human beings, pooled and divided. One portion was treated on a shaker delivering about 85 cycles per second; and the second portion was exposed to sonic vibration at a frequency of 9,000 cycles per second, power output of 50 watts. Standard 1.0 ml. aliquots diluted on blood agar in Petri plates were removed at varying time intervals. The plates were incubated aerobically at 37°C. for 48 hours; then all colonies appearing on the plates were counted. The results indicate that significantly higher counts are consistently obtained after sonic vibration. The effects of sonic vibration on the counts may be noted as early as after two minutes of exposure, but the highest counts seem to be obtained after about 10 minutes. After reaching a maximum, the counts become lower as the time of exposure is increased. Similar effects may be noted on the numbers of colonies of streptococci and lactobacilli when aliquots from the sample are inoculated on separate media. It is probable that these differences are due to a more homogeneous dispersion of bacteria after sonic vibration.

DEVELOPMENTAL DISTURBANCES OF ENAMEL IN SCURVY

Viktors Kalnins, p. 440.

Disturbances of enamel in scurvy and in the first stage of cure of scurvy were studied in guinea pigs. Findings showed that the first and characteristic scorbutic change was dysfunction, that is, the inability of the ameloblasts to produce enamel matrix (aplasia and hypoplasia), owing to the retardation or complete cessation of the development of dentin. This feature applies only to molars. Formation of enamel in incisors continued without interruption in spite of the full development of scurvy because in these teeth the enamel tissue is adjacent to the mantle dentin which remains unchanged in vitamin C deficiency.

The secondary and nontypical scorbutic changes are the disturbances of formation (hypoplasia) and of maturation (hypocalcification) owing to the detachment or pressure atrophy of the ameloblasts caused by the bending of the tooth wall or by the transmission of the masticatory forces into the formative portion of the molars and incisors.

The additional uptake of minerals into the enamel during the maturation phase is determined by the activity of the ameloblasts, not by the function of the pulp through the dentinoenamel junction.

Deaths

Anderson, John V., Kane, Pa.; College of Dentistry, University of Iowa, 1890; died May 22; aged 92.

Annis, A. A., Aspermont, Texas; died May 15; aged 76.

Auerbach, Isadore, Philadelphia; School of Dentistry, Temple University, 1924; died April 16.

Ball, Chester E., Chadron, Neb.; Dental School, Northwestern University, 1917; died May 20; aged 60.

Barr, Frederick A., Tarrytown, N. Y.; Baltimore College of Dental Surgery, University of Maryland, 1891; died May 5; aged 85.

Baxter, John R., Hyannis, Mass.; Dental School, Tufts College, 1900; died May 20; aged 78.

Bell, Royal S., Richfield, Utah; School of Dentistry, Georgetown University, 1928; died May 12; aged 55.

Brady, John J., Camp Hill, Pa.; School of Dentistry, Temple University, 1932; died May 14; aged 47.

Brandenburg, Frank J., Tulsa, Okla.; School of Dentistry, Washington University, St. Louis, 1918; died May 19; aged 59.

Breck, Charles W., Ada, Ohio; College of Dentistry, Ohio Medical University, 1902; died April 24; aged 73.

Brush, Frederick C., New York; New York College of Dentistry, 1895; died May 21; aged 81.

Bugbee, Leslie S., Kalispell, Mont.; Dental School, Northwestern University, 1899; died April 28; aged 74.

Bulger, Edward V., South Boston, Mass.; Dental School, Tufts College, 1900; died May 10.

Chakoian, Martin H., Chicago; Barnes Dental College, St. Louis, 1914; died May 1; aged 61.

Clark, Harry L., Oakland, Calif.; College of Physicians and Surgeons, San Francisco, 1915; died May 9.

Clinton, Ralph S., Washington, D. C., Dental Department, George Washington University, 1906; died May 4; aged 70.

Cockrum, Leland V., La Belle, Mo.; School of Dentistry, State University of Iowa, 1914; died May 3.

Cohn, Alvin C., Milwaukee; Dental School Marquette University, 1924; died May 9; aged 49.

Deibert, Franklin W., Gilbert, Pa.; died April 27.

Donovan, E. Harold, Plymouth, Mass.; Dental Department, George Washington University, 1919; died May 17; aged 58.

Eames, John E., Los Angeles; College of Dentistry, University of Southern California, 1917; died May 6.

Firth, Arthur J., Schenectady, N. Y.; Philadelphia Dental College, 1906; died May 17; aged 68.

Fowler, Henry E., Whitewater, Wis.; Chicago College of Dental Surgery, Loyola University, 1897; died April 29.

Franzmann, Robert J., North Bergen, N. J.; College of Dentistry, New York University, 1929; died May 17; aged 45.

Ganley, John E., Brocton, Mass.; School of Dentistry, Georgetown University, 1915; died May 21.

Gay, James L., Flushing, N. Y.; New York Dental School, 1897; died April 25; aged 79.

Gayle, Philip M., Waco, Texas; Atlanta Dental College, 1903; died May 16; aged 73.

Goerke, Francis C., Brooklyn; New York College of Dentistry, 1918; died April 10; aged 58.

Gould, Charles I., North Attleboro, Mass.; Dental School, Tufts College, 1900; died April 18; aged 82.

Gray, Joseph W., Cleveland; Dental School, Northwestern University, 1917; died April 29; aged 57.

Green, Leo, New York; School of Dental Medicine, Harvard University, 1897; died April 15; aged 76.

Gregg, Harry W., Tulsa, Okla.; Indiana Dental College, 1899; died April 27; aged 75.

Haig, Bahadrian B., Los Angeles; College of Dental and Oral Surgery, New York, 1923; died April 20; aged 67.

Hall, Samuel H., Stockton, Calif.; College of Physicians and Surgeons, San Francisco, 1908; died April 26; aged 66.

Hansen, Kai K., Santa Maria, Calif.; College of Dentistry, University of California, 1929; died May 11; aged 54.

Harnisch, Walter H., Syracuse, N. Y.; Baltimore College of Dental Surgery, University of Maryland, 1917; died May 16; aged 59.

Harrison, Grady H., Bedias, Texas; College of Dentistry, Baylor University, 1911; died April 19.

Hausman, Emanuel, South Orange, N. J.; School of Dentistry, University of Pennsylvania, 1911; died May 11.

Heck, David F., Chicago; Chicago College of Dental Surgery, Loyola University, 1911; died June 6; aged 76.

Hildebrand, John G., Waterloo, Iowa; College of Dentistry, University of Iowa, 1890; died June 14; aged 82.

Hillyer, Kenneth E., Brooklyn; New York College of Dentistry, 1916; died May 12; aged 56.

Holloway, George F., Glasgow, Ky.; Louisville College of Dentistry of Centre College, 1906; died April 23; aged 72.

Hudson, Edward B., Athens, Ga.; Atlanta Dental College, 1906; died May 10; aged 77.

Ireland, Dale W., Corning, Iowa; College of Dentistry, University of Nebraska; died April 25; aged 49.

Jaegeling, Julius P., San Francisco; College of Physicians and Surgeons, San Francisco, 1901; died May 29; aged 77.

Jarrett, Hanson A., Parkersburg, W. Va.; died January 15; aged 81.

Jefferson, Elvin V., Weiser, Idaho; School of Dentistry, North Pacific College of Oregon, 1906; died April 27.

Kaletsky, Theodore, Jamaica, N. Y.; College of Dental and Oral Surgery, New York, 1917; died May 21; aged 55.

Karceski, Harry A., Rockford, Ill.; College of Dentistry, University of Illinois, 1938; died May 4; aged 38.

Keehan, James H., Marcus Hook, Pa.; died April 18.

Kelly, John F., Dallas, Texas; State Dental College, Dallas, 1917; died April 25; aged 61.

Kemper, John W., Ann Arbor, Mich.; College of Dental Surgery, University of Michigan, 1917; died May 8; aged 60.

Klein, Francis A., Buffalo; School of Dentistry, University of Buffalo, 1935; died May 14; aged 43.

LeBlanc, Joseph H., Baton Rouge, La.; School of Dentistry, Tulane University, 1905; died May 12; aged 71.

Lewis, Arley C., Albany, N. Y., School of Dentistry, University of Pennsylvania, 1906; died May 25; aged 67.

Lieberman, A. Benjamin, Jamaica, N. Y.; College of Dental and Oral Surgery, New York, 1917; died February 17.

Longwell, Harry G., Camden, N. J., Philadelphia Dental College, 1902; died April 23; aged 77.

Lopez, Frederick R., Brooklyn; College of Dentistry, New York University, 1920; died April 21.

Marcan, Carl M., Milwaukee; Dental School, Marquette University, 1908; died April 19.

Marquis, Lawrence V., Sharon, Pa.; School of Dentistry, University of Pittsburgh, 1899; died April 24; aged 87.

Mattingly, Joseph, Chicago; Chicago College of Dental Surgery, Loyola University, 1907; died June 6; aged 73.

McCall, Stuart W., Council Bluffs, Iowa; College of Dentistry, Creighton University, 1907; died April 28; aged 70.

McCarron, Joseph M., Philadelphia; School of Dentistry, University of Pennsylvania, 1899; died May 15.

McDaniel, Hollis, Chicago; Chicago College of Dental Surgery, Loyola University, 1927; died June 9; aged 52.

McIntire, Harold E., Hutchinson, Minn.; College of Dentistry, University of Minnesota, 1921; died May 13; aged 53.

McMichael, Charles A., Miami, Fla.; School of Dentistry, Western Reserve University, 1911; died May 1; aged 65.

Miller, Anthony G., Washington, D. C.; School of Dentistry, Georgetown University, 1923; died April 24.

Miller, Sanford W., San Mateo, Calif.; College of Physicians and Surgeons, San Francisco, 1906; died May 16; aged 70.

Morrison, Robert E., Owensboro, Ky.; Pennsylvania College of Dental Surgery, Philadelphia, 1890; died April 25; aged 87.

Mullan, Charles E., Annapolis, Md.; Baltimore College of Dental Surgery, University of Maryland, 1905; died May 6; aged 74.

Murray, William J., New York; Dental School, Harvard University, 1923; died May 17; aged 52.

Noland, Claire A., Monroe City, Mo.; Western Dental College, Kansas City, 1902; died May 26; aged 70.

O'Connor, William J., Worcester, Mass.; Dental School, Tufts College, 1912; died May 18; aged 67.

Patton, Mark A., Virden, Ill.; School of Dentistry, Washington University, St. Louis, 1929; died March 6; aged 49.

Pearce, James H., Peoria, Ill.; died April 19.

Pettibone, Milton E., Sidney, Neb.; College of Dentistry, Creighton University, 1909; died April 29; aged 69.

Robinson, John W., Auburn, Maine; Atlanta-Southern Dental College, 1897; died May 20.

Roche, John J., Hartford, Conn.; School of Dentistry, Temple University, 1909; died May 20.

Ross, Joseph, Newark, N. J., Baltimore College of Dental Surgery, University of Maryland, 1905; died May 4; aged 77.

Ruester, Valentine E., Warrenton, Mo.; School of Dentistry, St. Louis University, 1912; died May 13; aged 62.

Ruyle, John B., Champaign, Ill.; School of Dentistry, St. Louis University, 1919; died May 7; aged 55.

Schwalen, Edmond B., Chicago; Dental School, Northwestern University, 1914; died June 5; aged 54.

Sinkler, Samuel B., Chicago; Chicago College of Dental Surgery, Loyola University, 1917; died in April; aged 74.

Skaggs, Erastus P., Topeka, Kan.; Baltimore College of Dental Surgery, University of Maryland, 1906; died April 30.

Slatoff, Henry C., New York; New York College of Dentistry, 1916; died May 18; aged 60.

Sloman, Ernest G., San Francisco; College of Physicians and Surgeons, San Francisco, 1921; died April 30; aged 56.

Smith, Walter C., East St. Louis, Ill.; Dental School, Northwestern University, 1900; died May 15; aged 78.

Smith, William L., Bridgeport, Conn.; School of Dentistry, University of Pennsylvania, 1916; died April 29; aged 60.

Solomon, Jacob L., Newark, N. J., Baltimore College of Dental Surgery, University of Maryland, 1910; died May 8; aged 68.

Sook, Henry B., Baker, Ore.; School of Dentistry, North Pacific College of Oregon, 1905; died May 18; aged 74.

Souter, Merton C., Detroit; College of Dental Surgery, University of Michigan, 1910; died May 20; aged 68.

Sroka, John J., Chicago; College of Dentistry, University of Illinois, 1923; died May 20; aged 57.

Standen, John A., St. Davids, Pa.; School of Dentistry, University of Pennsylvania, 1902; died May 12; aged 71.

Stiefel, Leopold, Philadelphia; Pennsylvania College of Dental Surgery, Philadelphia, 1901; died April 25; aged 75.

Thomson, Raymond, Utica, N. Y.; died April 29.

Toay, Corliss S., Stoughton, Wis.; Dental School, Northwestern University, 1919; died May 15; aged 66.

Turney, Thomas J., Sterling, Ill.; Chicago College of Dental Surgery, Loyola University, 1912; died April 22.

Tutt, Arthur M., Liberty, Mo.; Kansas City Dental College, 1892; died April 14; aged 81.

Vastola, Andrew J., Buffalo; School of Dentistry, University of Buffalo, 1943; died June 11; aged 35.

Veach, Charles L., Bellevue, Iowa; College of Dentistry, University of Iowa, 1916; died June 3; aged 58.

Wade, Carlton E., Cuthbert, Ga.; Atlanta-Southern Dental College, 1921; died May 6; aged 56.

Washington, Clarence J., Memphis, Tenn.; School of Dentistry, Vanderbilt University, 1892; died May 23; aged 85.

Weisel, Herbert W., Lincoln, Neb.; College of Dental Surgery, University of Michigan, 1916; died May 14; aged 57.

West, A. Wayman, Montgomery, Ala.; Dental Department, Meharry Medical College, 1911; died April 10; aged 69.

Wilder, Eugene M., Augusta, Ga.; Atlanta-Southern Dental College, 1898; died May 29; aged 76.

Williams, Charles R., Wetumka, Okla.; Kansas City Dental College, 1919; died March 24; aged 57.

Williams, Howard S., Meriden, Conn.; School of Dentistry, University of Pennsylvania, 1899; died April 27; aged 75.

Williamson, Norman A., Knoxville, Tenn.; Atlanta-Southern Dental College, 1903; died June 14; aged 74.

Williamson, Thomas H., Ithaca, N. Y.; School of Dentistry, University of Buffalo, 1929; died March 7; aged 48.

Wilson, J. Seward, Bristol, Conn.; died June 8; aged 87.

Wimberly, Elver B., Fort Smith, Ark.; Kansas City-Western Dental College, 1926; died June 3; aged 48.

Winegard, Floyd P., Dayton, Ohio; Ohio College of Dental Surgery, University of Cincinnati, 1918; died June 6; aged 56.

Wock, A. Brownell, Johnstown, N. Y.; School of Dentistry, University of Buffalo, 1923; died March 1; aged 62.

Wolcott, Floyd G., Janesville, Wis.; Chicago College of Dental Surgery, Loyola University, 1901; died April 23; aged 73.

Woolf, Samuel, Lynbrook, N. Y.; School of Dental and Oral Surgery, Columbia University, 1926; died March 27; aged 50.

Zell, A. L., Lawton, Okla.; died April 1.

Ziegler, Louis C., Allentown, Pa.; School of Dentistry, University of Louisville, 1920; died June 4; aged 58.

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Announcements

MEETINGS OF THE AMERICAN DENTAL ASSOCIATION

Ninety-Third Annual Session	Sept. 8-11, 1952	St. Louis
Ninety-Fourth Annual Session	Sept. 28-Oct. 1, 1953	Cleveland
Ninety-Fifth Annual Session	Nov. 8-11, 1954	Miami

MEETINGS OF STATE SOCIETIES

State	Date	Place	Secretary	Address
Alabama	Apr. 9-11, 1953	Montgomery	F. A. Finney, Jr.,	1045 Forrest Ave., Gadsden
Alaska	July 22-25, 1953	Juneau	J. D. Smith	Juneau
Arizona			E. M. Scott	15 E. Monroe, Phoenix
Arkansas	Oct. 26-28	Little Rock	D. M. Hamm	White Bldg., Clarksville
California	Apr. 13-15, 1953	San Francisco	L. R. Ludwigsen	450 Sutter St., San Francisco
S. California	Apr. 20-22, 1953	Los Angeles	C. A. Moss	903 Crenshaw Blvd., Los Angeles
Colorado	Oct. 5-8	Colorado Springs	R. A. Downs	1422 Grant St., Denver
Connecticut			E. S. Arnold	37 Linnard Rd., W. Hartford
Delaware	Jan. 14, 1953	Wilmington	J. J. Ficca	2130 Lancaster Ave., Wilmington
District of Columbia	Mar. 15-18, 1953	Washington	K. H. Wood	202-1835 Eye St., N. W., Washington
Florida	Apr. 19-22, 1953	St. Petersburg	C. T. Brown	602 Citizens Bldg., Tampa 2
Georgia	Oct. 12-15	Savannah	J. M. Heard, Jr.	803 Persons Bldg., Macon
Hawaii		Honolulu	J. H. Dawe	810 N. Vineyard St., Honolulu 17
Idaho	June 18, 1953	Sun Valley	J. F. Julian	206 Rogers Bldg., Idaho Falls
Illinois	May 11-14, 1953	Peoria	P. W. Clopper	623 Jefferson Bldg., Peoria 2
Indiana	May 18-20, 1953	Indianapolis	E. E. Ewbank	Kingman
Iowa	May 4-6, 1953	Des Moines	H. I. Wilson	639 Insurance Exchange Bldg., Des Moines
Kansas	May 10-12, 1953	Kansas City, Mo.	F. A. Richmond	861 Brotherhood Bldg., Kansas City
Kentucky	Apr. 7-9, 1953	Louisville	A. B. Coxwell	1976 Douglass Blvd., Louisville
Louisiana	Apr. 29-May 2, 1953	New Orleans	J. S. Bernhard	2515 Line Ave., Shreveport
Maine	June 25-27, 1953	Rockland	S. Gower	Box 27, Skowhegan
Maryland	Sept. 21-23	Baltimore	E. L. Pessagno, Jr.	415 Medical Arts Bldg., Baltimore 1
Massachusetts	May 3-6, 1953	Boston	H. E. Tingley	12 Bay State Road, Boston
Michigan	Apr. 20-23, 1953	Detroit	F. Wertheimer	Michigan Dept. of Health, Lansing
Minnesota	Feb. 23-25, 1953	Minneapolis	C. V. E. Cassel	242 Lowry Medical Arts Bldg., St. Paul
Mississippi		Jackson	H. M. Campbell	102 Professional Bldg., Tupelo
Missouri	May 10-13, 1953	Kansas City	R. R. Rhoades	201 Merchants Bank Bldg., Jefferson City
Montana	May 7-8, 1953	Missoula	C. S. Renouard	304 Phoenix Bldg., Butte
Nebraska	May 1953	Lincoln	F. A. Pierson	1112 Federal Securities Bldg., Lincoln
Nevada		Las Vegas	J. E. Ahlstrom	1150 Arizona, Boulder City
New Hampshire	June 11-14, 1953	Bretton Woods	F. E. Williams	814 Elm St., Manchester
New Jersey	April 22-24, 1953	Atlantic City	J. G. Carr	407 Cooper St., Camden
New Mexico	May 24-27, 1953	Albuquerque	J. S. Eilar	Suite 7, Medical Arts Square, Albuquerque
New York	May 12-15, 1953	New York	C. A. Wilkie	1 Hanson Place, Brooklyn
North Carolina	May 17-20, 1953	Pinehurst	B. N. Walker	Liberty Life Bldg., Charlotte
North Dakota	May 24-27, 1953	Fargo	J. H. Lunday	302 Black Bldg., Fargo
Ohio	Nov. 9-12	Columbus	E. G. Jones	185 E. State St., Columbus
Oklahoma	Apr. 19-22, 1953	Tulsa	D. Robertson	434 N. W. 13th St., Oklahoma City
Oregon	Mar. 2-4, 1953	Portland	H. C. Fixott, Jr.	Medical Dental Bldg., Portland

State	Date	Place	Secretary	Address
Panama Canal Zone	Dec. 9		F. D. Buckley	Box 293, Rodman
Pennsylvania			M. D. Zimmerman	217 State St., Harrisburg
Puerto Rico	Jan. 1953		A. Quiñones	San German
Rhode Island	Jan. 13, 14, 1953	Providence	E. L. Bessette	1745 Broad St., Cranston 5
South Carolina	June, 1953	Greenville	J. R. Owings	7 Medical Court, Greenville
South Dakota	May, 1953	Rapid City	E. W. Elmen	Sioux Falls
Tennessee	May 11-14, 1953	Knoxville	W. L. McCulley	Brown Bldg., Cleveland
Texas	May 10-14, 1953	Houston	W. Ogle	3607 Gaston Ave., Dallas
Utah			K. L. Dedekind	914 Medical Arts Bldg., Salt Lake City
Vermont	May 17-19, 1953	Woodstock	W. J. Reardon	Rutland
Virginia	May 4-6, 1953	Roanoke	J. E. John	804 Medical Arts Bldg., Roanoke
Washington	June 18-20, 1953	Yakima	F. J. Dingler	1502 Medical-Dental Bldg., Seattle
West Virginia	July 13-15, 1953	White Sulphur Springs	A. B. Drake	506 West Virginia Bldg., Huntington 1
Wisconsin	Apr. 6-9, 1953	Milwaukee	R. A. Mason	964 N. 27th St., Milwaukee
Wyoming		Casper	T. J. Drew	State Capitol Bldg., Cheyenne

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

State	Date	Place	Secretary	Address
Alabama			M. D. Edwards	132 Adams Ave., Montgomery
Alaska			J. H. Geyer	P. O. Box 915, Juneau
Arizona			R. K. Trueblood	25 N. Second Ave., Glendale
Arkansas			H. O. Weatherly	205 Halter Bldg., Conway
California			K. I. Nesbitt	507 Polk St., San Francisco 2
Colorado			C. K. Phillips	724 Republic Bldg., Denver 2
Connecticut	Nov.	Bridgeport	C. G. Brooks	302 State St., New London
Delaware			P. K. Musselman	143 W. Main St., Newark
District of Columbia			Woodson T. Birthright	1835 Eye St., N. W., Washington 6
Florida			A. W. Kellner	P. O. Box 155, Hollywood
Georgia			S. H. Yarbrough	Medical Arts Bldg., Columbus
Hawaii	Aug. 27-Sept. 1*	Honolulu	H. L. Houvener	427 Dillingham Bldg., Honolulu
Idaho			W. K. Adams	1624 Arlington, Caldwell
Illinois	Oct. 21-24	Chicago	W. A. McKee	503 Wood Bldg., Benton
Indiana	Nov. 17-20*	Indianapolis	C. A. Frech	504 Broadway, Gary
Iowa			H. M. Willits	719 Roshek Bldg., Dubuque
Kansas			G. L. Teall	Box 71, Hiawatha
Kentucky			R. I. Todd	Western Union Bldg., Richmond
Louisiana			A. R. de Nux	Marksville
Maine			R. A. Derbyshire	Box 387, Skowhegan
Maryland	Nov.	Baltimore	H. Levin	3429 Park Heights Ave., Baltimore 15
Massachusetts			R. A. Barrette	Rm. 33 State House, Boston
Michigan	Jan. 26-30, 1953 June 8-12, 1953	Ann Arbor	J. L. Champagne	3714 W. McNichols Road, Detroit 21
Minnesota			F. A. Larson	1632 Washington St., N. E., Minneapolis
Mississippi	June 5-7, 1953	Jackson	J. C. Boswell	508 Lamar Life Bldg., Jackson
Missouri			R. R. Rhoades	414 Central Trust Bldg., Jefferson City
Montana			V. J. Quinn	Box 865, Helena
Nebraska			H. E. Weber	1210 Federal Securities Bldg., Lincoln
Nevada			G. C. Steinmiller	Suite 6, Masonic Temple, P. O. Box 2473, Reno
New Hampshire			D. J. Freese	4 Wall St., Concord
New Jersey	Dec. 8, 9***‡‡ Dec. 10-12§	Philadelphia Trenton	W. A. Wilson	150 E. State St., Trenton 8
New Mexico			J. J. Clarke, Sr.	Artesia
New York	Oct. 9, 10** Oct. 14-17§	New York Buffalo Buffalo Albany	D. W. Beier	23 S. Pearl St., Albany 7
North Carolina			F. O. Alford	1109 Liberty Life Bldg., Charlotte 2
North Dakota			A. B. Crabtree	Ellendale
Ohio	Oct. 27-31	Columbus	H. B. Smith	322 E. State St., Columbus
Oklahoma			J. B. Cole	706 Asp St., Norman
Oregon	Dec. 8-11	Portland	F. L. Utter	506 Pioneer Trust Bldg., Salem
Pennsylvania			A. M. Stinson	Dept. of Public Instruction Box 911, Harrisburg

State	Date	Place	Secretary	Address
Puerto Rico	Sept.	Santurce	L. C. Coll	Box 9156, Santurce
Rhode Island	Nov. 25, 26	Providence	F. M. Hackett	267 Academy Ave., Providence
South Carolina			T. C. Sparks	1315 Pickens St., Columbia
South Dakota			O. Isaak	Tyndall
Tennessee	Dec. 10-15	Memphis	F. S. Maxey	804 Bennie Dillon Bldg., Nashville 3
Texas	Oct. 20, 21‡‡ Oct. 20-24†	Houston	R. T. Weber	312 Capital National Bank Bldg., Austin
Utah			M. W. Merrill	820 N. University Ave., Provo
Vermont			F. A. Reid	Windsor
Virginia	June 8, 9, 1953‡‡ June 8-12, 1953†	Richmond	J. M. Hughes	715 Medical Arts Bldg., Richmond 19
Washington	Jan. 12, 1953	Seattle	J. B. Keifer, Jr.	510 Cobb Bldg., Seattle
West Virginia			C. A. Laughlin	613 Prunty Bldg., Clarksburg
Wisconsin			S. F. Donovan	Tomah
Wyoming			W. A. Hocker	212 O & S Bldg., Casper

*Dentistry and dental hygiene.
**Dental clinical examinations.
†Dental examinations.
‡Dental written examinations.
‡‡Hygienists' examinations.

MEETINGS OF OTHER ORGANIZATIONS

Name	Date	Place	Secy. or Chm.	Address
Academy of Denture Prosthetics	Apr. 12-19, 1953	Los Angeles	I. L. Furnas Secy.	928 Silverado St., La Jolla, Calif.
American Academy of Dental Medicine	Dec. 7	New York	W. M. Greenhut Secy	124 E. 84th St., New York 28
American Academy of Periodontology	Sept. 4-6	St. Louis	C. E. Chamberlain Secy.	115 North St., Peoria 5, Ill.
American Association of Dental Examiners	Sept. 5-6	St. Louis	C. A. Bumstead Secy.	924 Stuart Bldg., Lincoln, Neb.
American Association of Dental Schools	Mar. 23-25, 1953	Philadelphia	M. W. McCrea Secy.	Baltimore College of Dental Surgery, Dental School, University of Maryland, Baltimore 1
American Association of Orthodontists Central Section	Oct. 13, 14	Omaha	F. B. Lehman Secy.	1126 Merchants National Bank Bldg., Cedar Rapids, Iowa
American Board of Dental Public Health	Sept. 12, 13	St. Louis	P. E. Blackerby, Jr. Secy.	250 Champion St., Battle Creek, Mich.
American Board of Oral Pathology	Sept. 7	St. Louis	J. L. Bernier Secy.	Army Institute of Pathology, Washington, D. C.
American Board of Oral Surgery	Oct. 5-8	New Orleans	L. M. FitzGerald Secy.	718 Roshek Bldg., Dubuque, Iowa
American Board of Orthodontics	Apr. 22-26 1953	Dallas, Texas	C. E. Martinek Secy.	661 Fisher Bldg., Detroit 2
American Board of Prosthodontics	Feb. 1-7, 1953	Indianapolis	I. R. Hardy Secy.	Tufts College Dental School, 136 Harrison Ave., Boston 11
American College of Dentists	Sept. 7	St. Louis	O. W. Brandhorst Secy.	4952 Maryland Ave., St. Louis 8
American Dental Assistants Association	Sept. 8-11	St. Louis	M. L. Martin Secy.	410 First National Bank Bldg., La Porte, Ind.
American Denture Society	Sept. 5, 6	St. Louis	A. L. Roberts Secy.	Aurora National Bank Bldg., Aurora, Ill.
American Public Health Association	Oct. 20-24	Cleveland	R. M. Atwater Exec. Secy.	1790 Broadway, New York 19
American Society for the Advancement of General Anesthesia In Dentistry	Oct. 27	New York	M. H. Feldman Exec. Secy.	750 Fifth Ave., New York

Name	Date	Place	Secy. or Chm.	Address
American Society of Oral Surgeons	Oct. 8-11	New Orleans	R. F. Whalen Exec. Secy.	1112 E. Clay St., Richmond, Va.
Chicago Dental Society	Feb. 8-11, 1953	Chicago	K. S. Richardson Exec. Secy.	30 N. Michigan Ave., Chicago 2
Council on Dental Education, Dental Aptitude Tests	Oct. 24, 25		S. Peterson Secy.	222 E. Superior St., Chicago 11
Dallas Mid-Winter Dental Clinic	Jan. 25-28, 1953	Dallas, Texas	W. C. McCaskill, Jr. Gen. Chm.	1329 Medical Arts Bldg., Dallas, Texas
Great Lakes Society of Oral Surgeons	Sept. 21	Cleveland	B. B. Cook Secy.	10314 Puritan Ave., Detroit 21
Greater New York Dental Meeting	Dec. 8-12	New York	A. E. Corby Chm.	Hotel Statler, Room 106A, New York
International Academy of Anesthesiology	Oct. 15	New York	I. G. Tomack Exec. Secy.	355 E. 149th St., New York 55
International Association for Dental Research	Mar. 20-22, 1953	Philadelphia	E. H. Hatton Secy.	311 E. Chicago Ave., Chicago 11
National Board of Dental Examiners	Dec. 1, 2		S. Peterson Secy.	222 E. Superior St., Chicago 11
New England Dental Society	Oct. 1, 2	Boston	A. R. Wilson Secy.	43 Farmington Ave., Hartford, Conn.
New Orleans Dental Conference	Nov. 9-12	New Orleans	M. R. Matta Secy.	629 Maison Blanche Bldg., New Orleans
Northeastern Society of Orthodontists	Nov. 10, 11	Montreal, Canada	O. Jacobson Secy.	35 W. 81st St., New York
Odontological Society of Western Pennsylvania	Nov. 11-13	Pittsburgh	W. E. Craig Secy.	206 Jenkins Bldg., Pittsburgh 22
Southeastern Society of Oral Surgeons	Mar. 6, 7, 1953	Birmingham, Ala.	C. F. Landeis Secy.	316 James Bldg., Chattanooga, Tenn.
Southwestern Society of Orthodontists	Oct. 26-29	San Antonio, Texas	F. A. Boyd Secy.	1502 N. Third, Abilene, Texas

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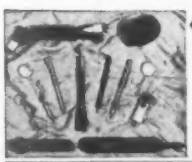

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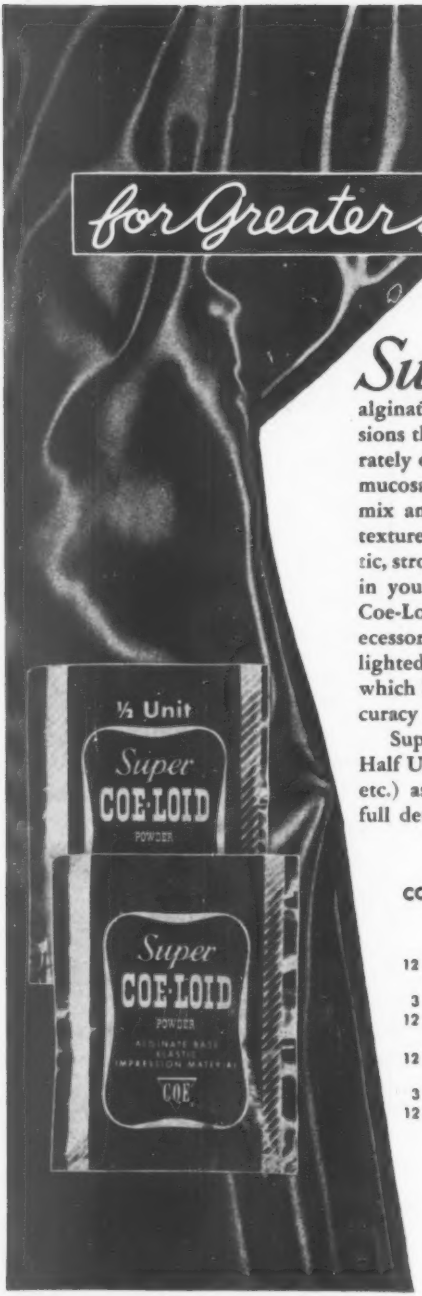

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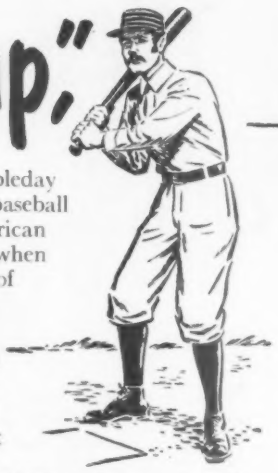

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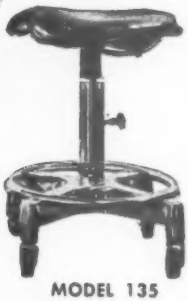

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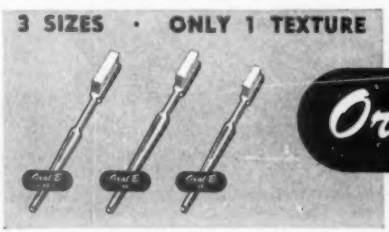

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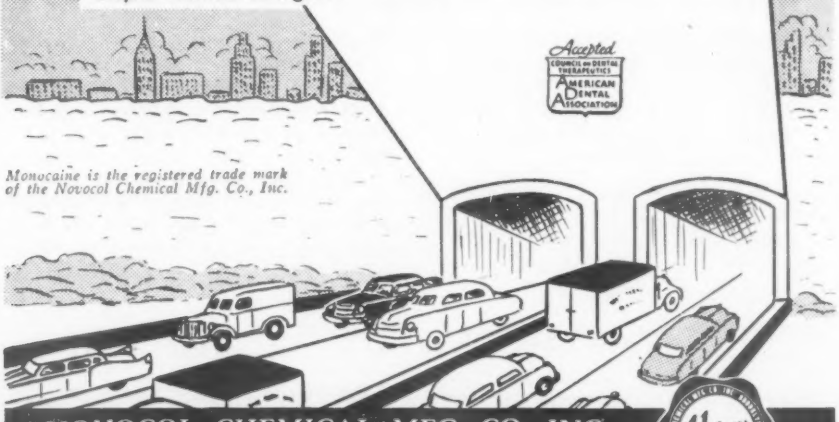

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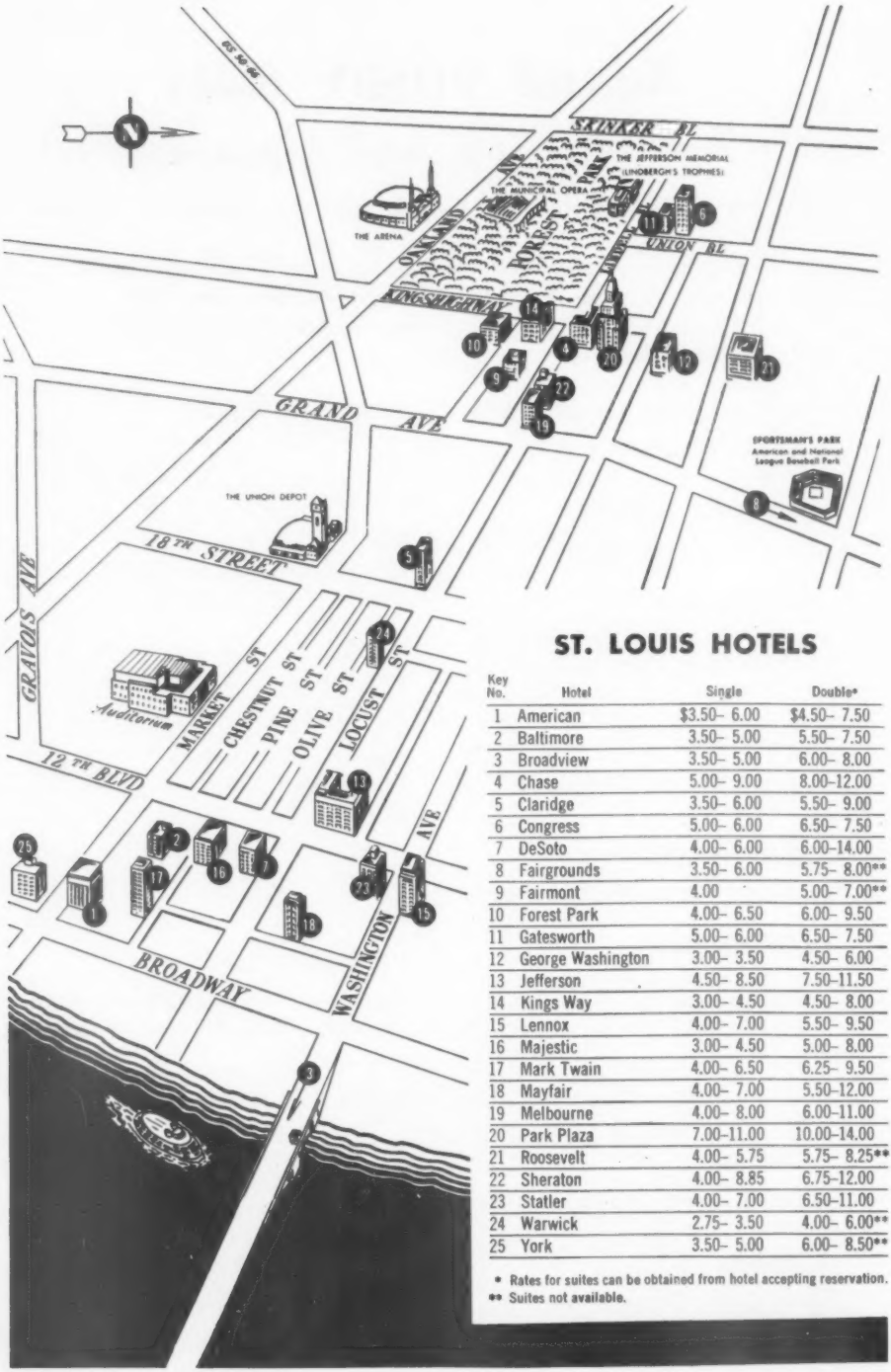

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(1) Berk, H., J. Dent. for Child., 17:65 (4th quarter) 1950.

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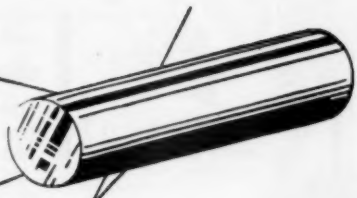

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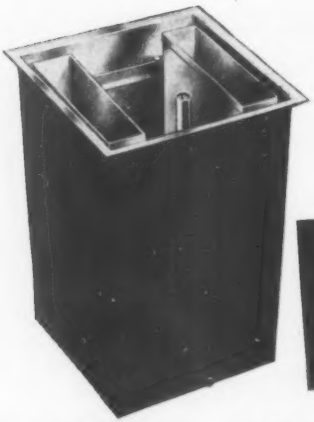

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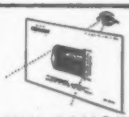

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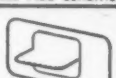

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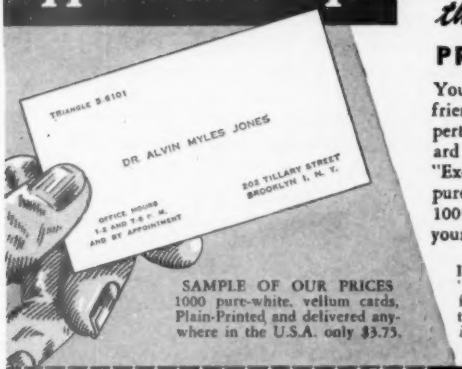

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What is true of a good breakfast applies to other meals. An adequate diet, including dairy foods and other protective foods, can be a great asset in increasing efficiency of workers and building national strength.

1. Tuttle, W. W., Daum, K., Myers, L., and Martin, C. Effect of omitting breakfast on the physiologic response of men. J. Am. Diet Assn. 26:332 (May) 1950

2. Orent-Keiles, E. and Hallman, L. F. The breakfast meal in relation to blood sugar values. U.S.D.A. Circ. 827. Washington, 1949

3. Leverton, R. M. and Gram, M. R. Nitrogen excretion of women related to the distribution of animal protein in daily meals. J. Nutr. 39:57 (Sept.) 1949

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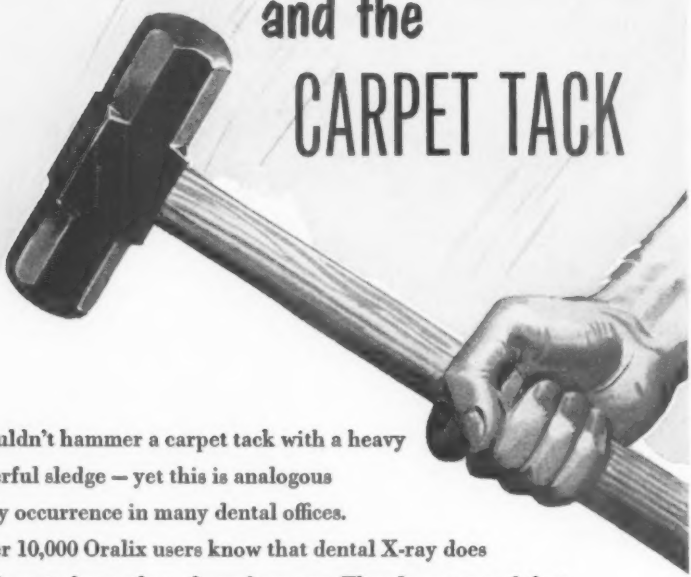

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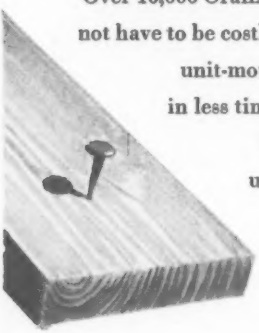

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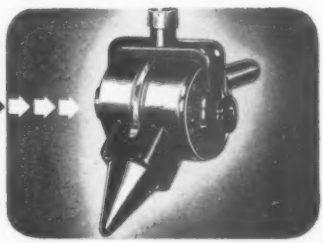

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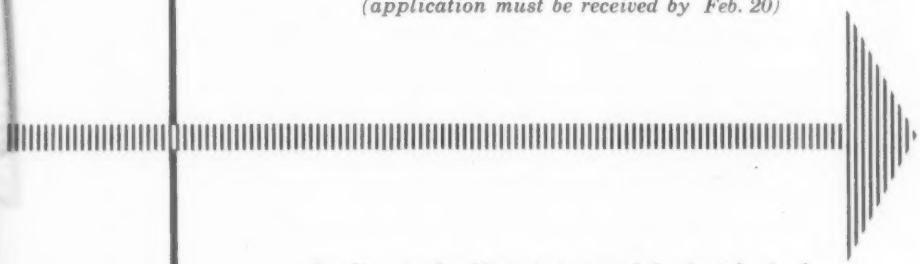

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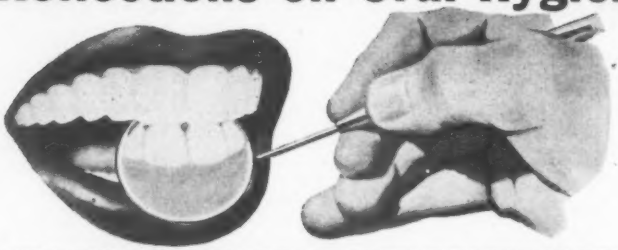

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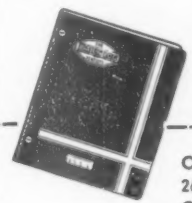

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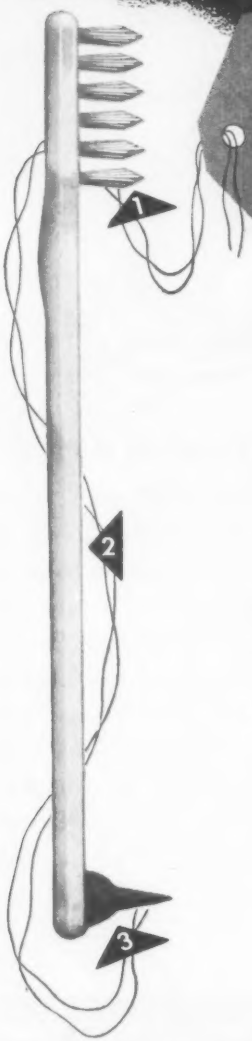

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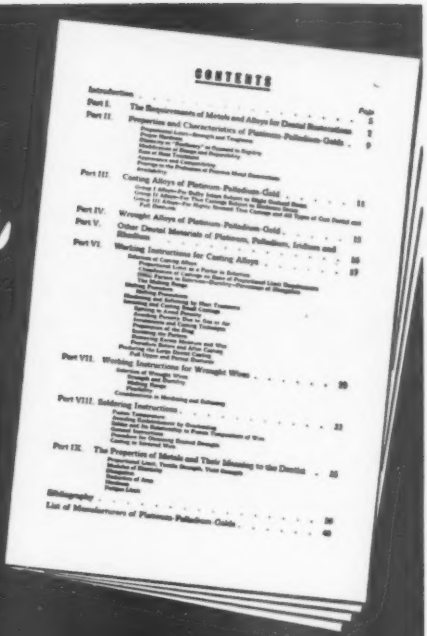
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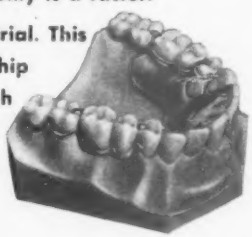

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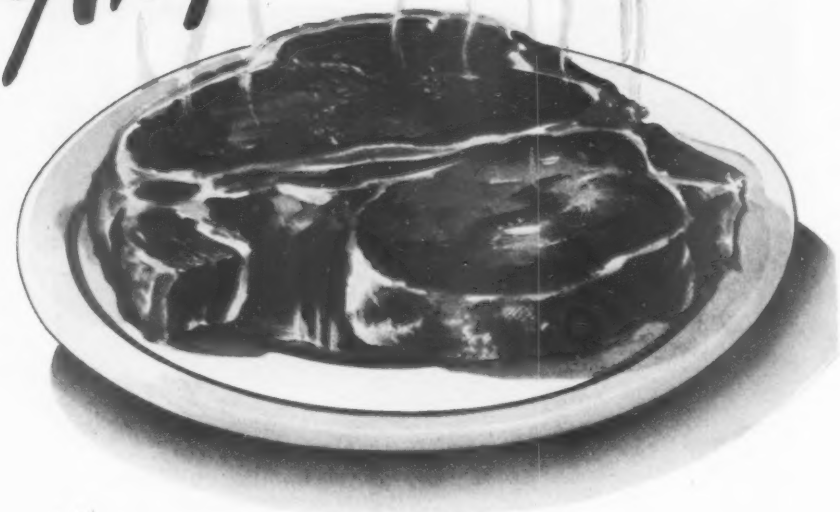

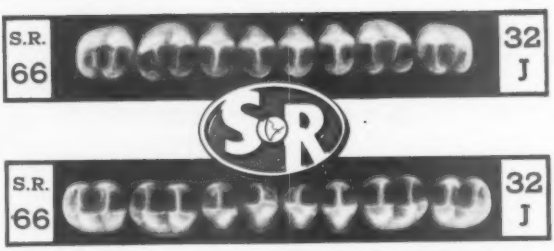

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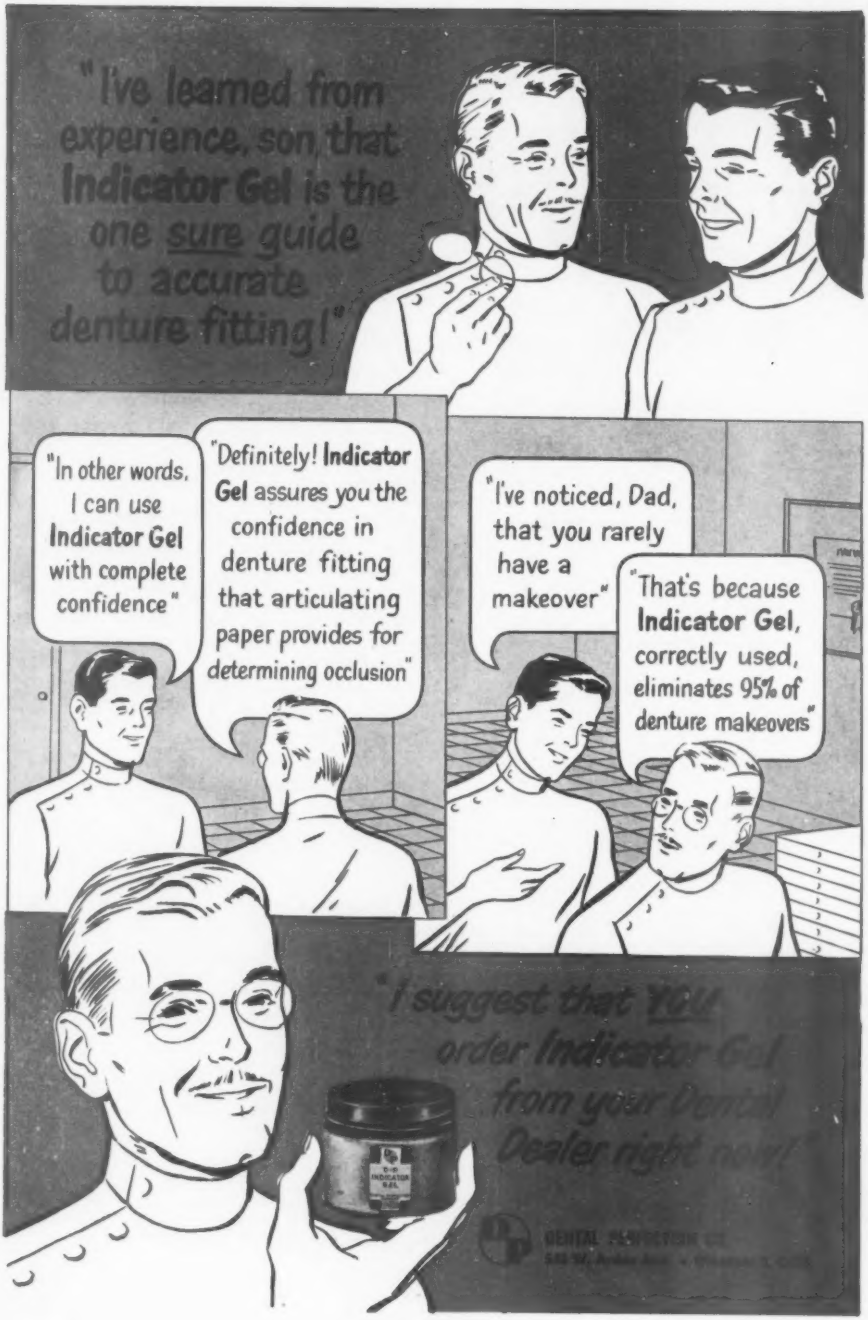
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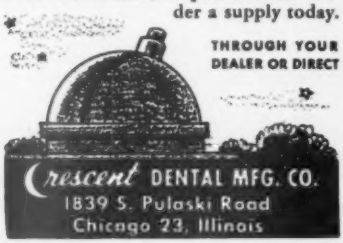

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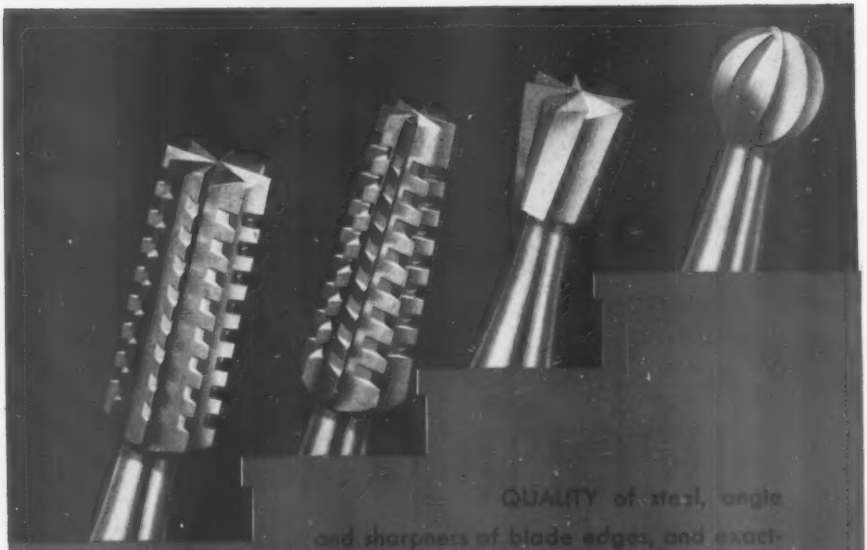

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1. *Dental Survey*, 25, 368-9, (1949)
2. *Gordon, S.: Dental Service and Dental Art*, p. 616, Lea & Febiger, (1939)
3. *Shotwell, James E., Toxic Effects Following Local Anesthesia: Oral Surg., Oral Med. & Oral Path.* 1, 750-5 (1948)

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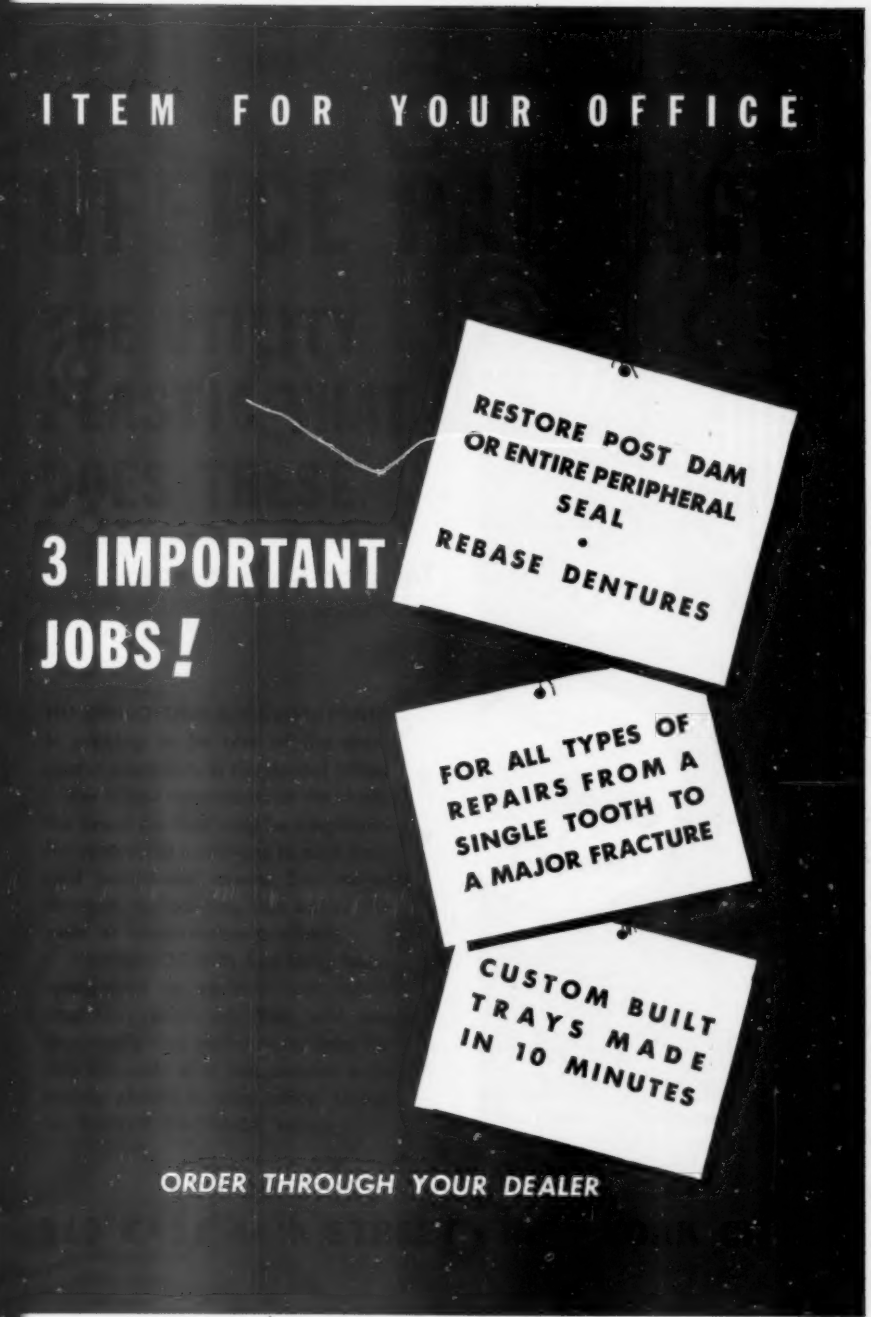
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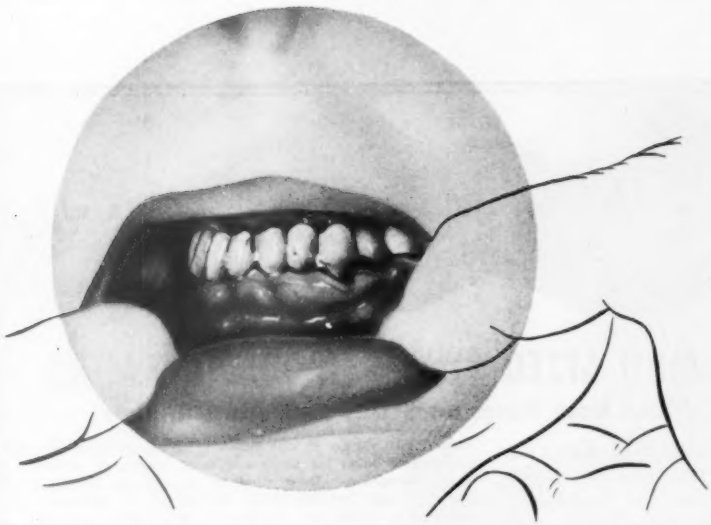

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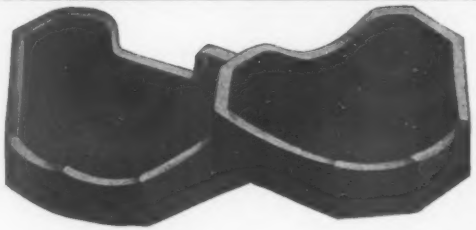

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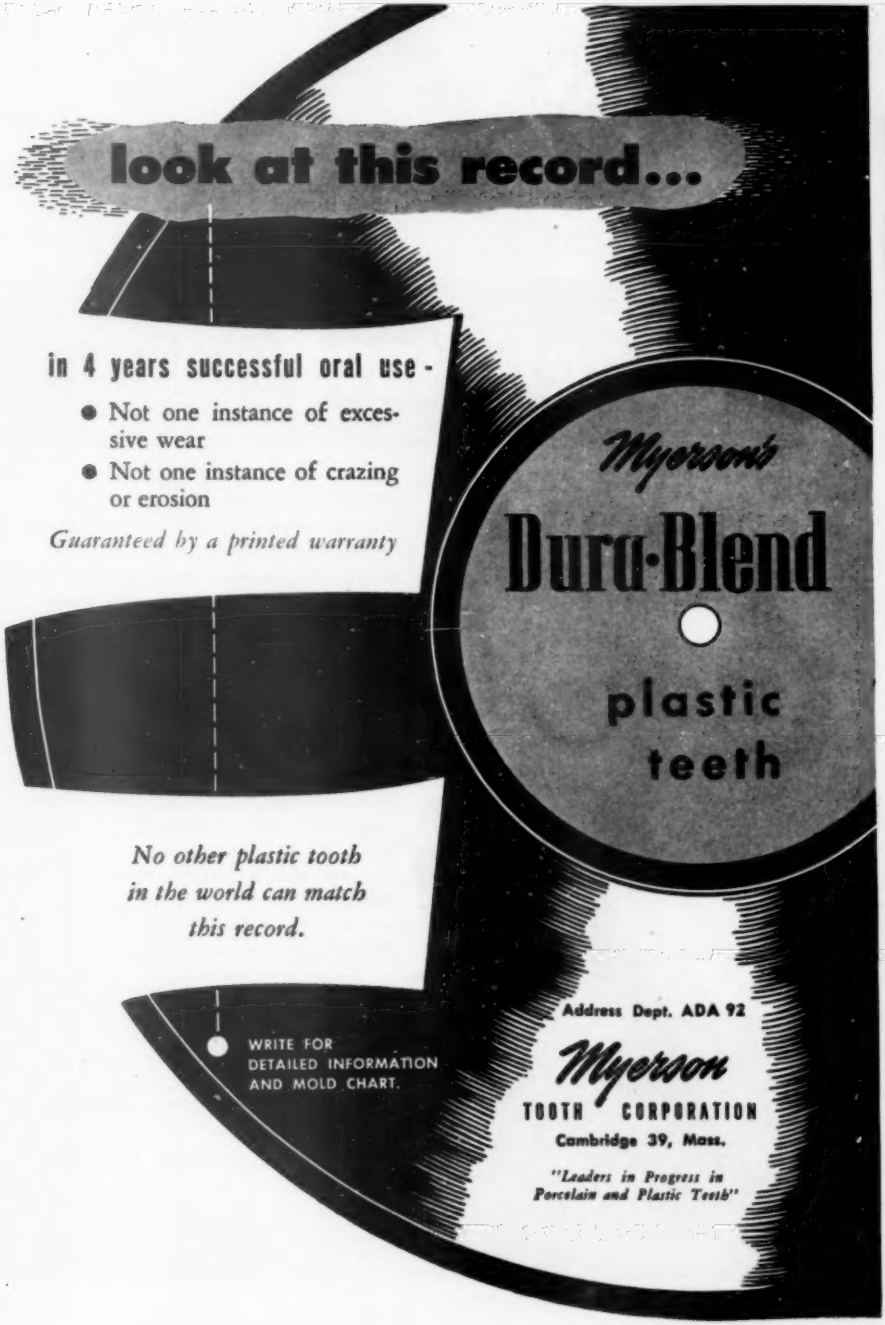
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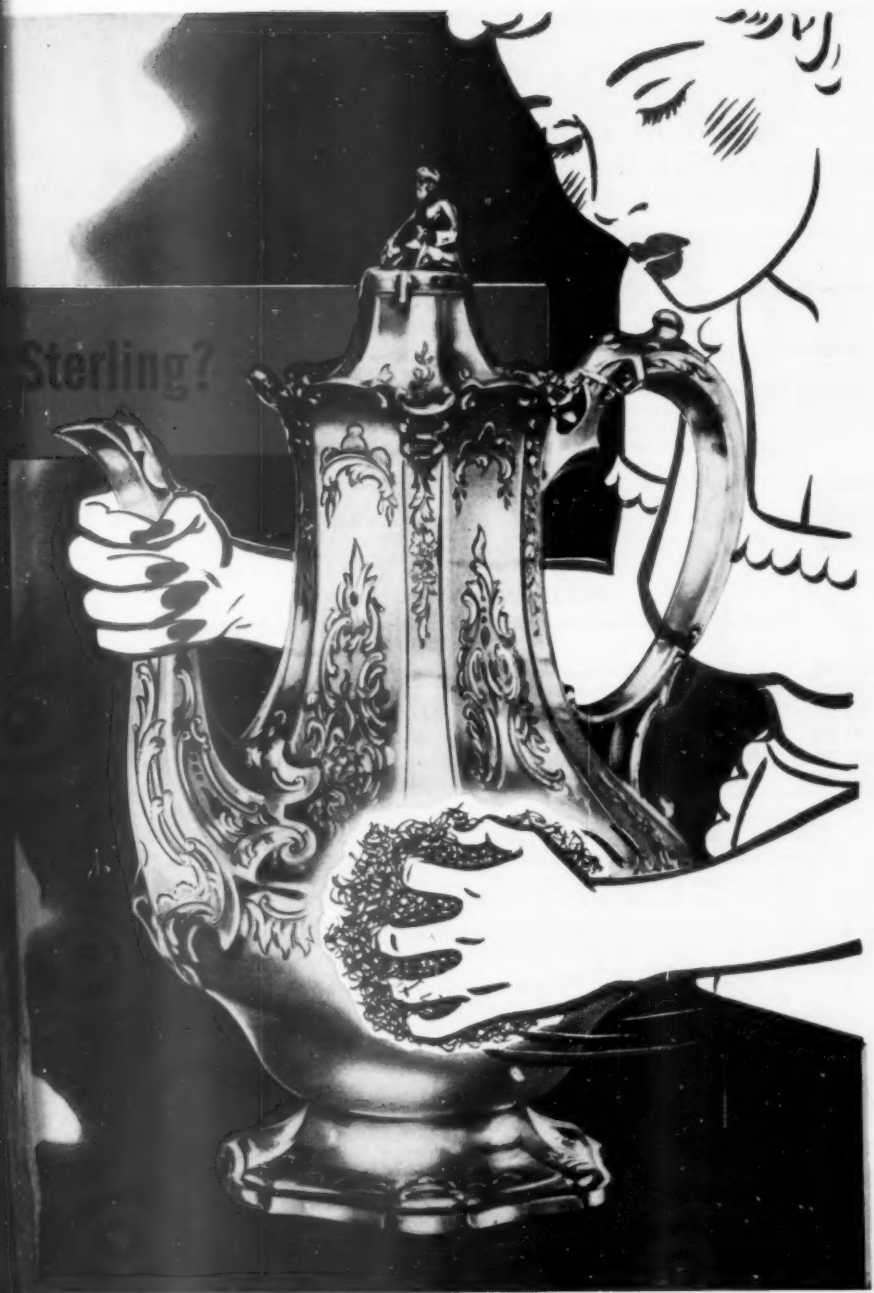
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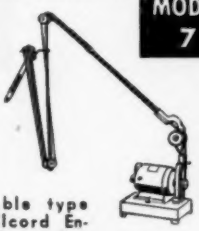

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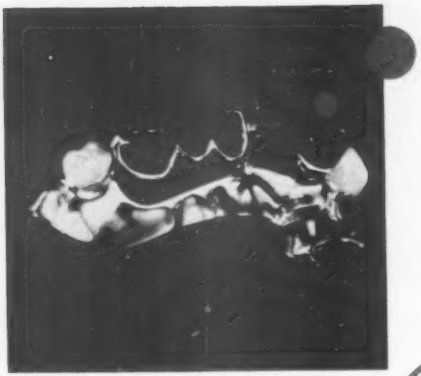

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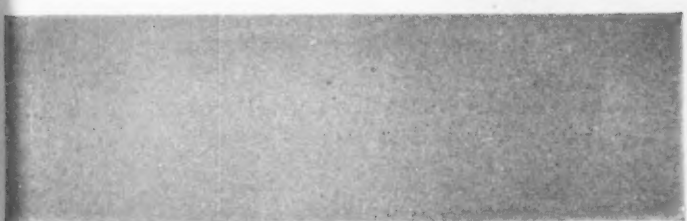

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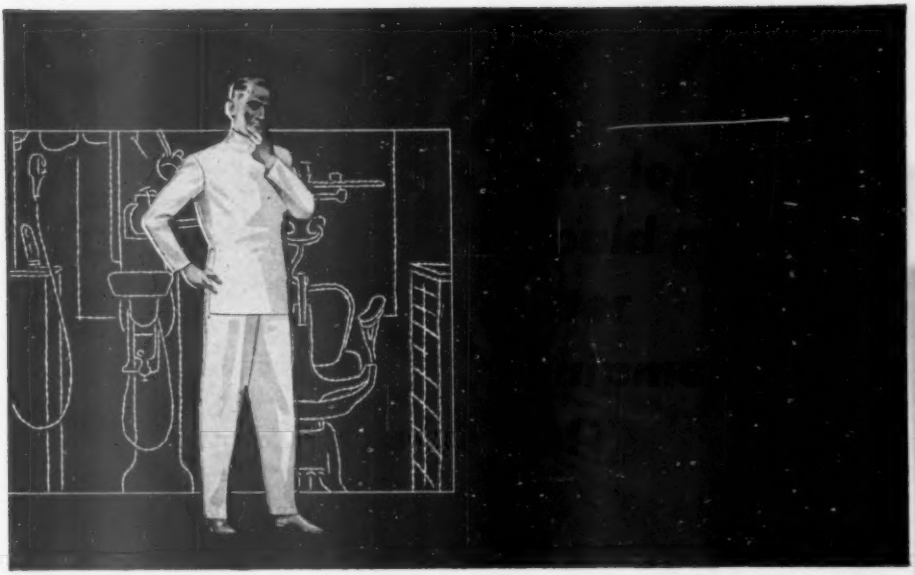

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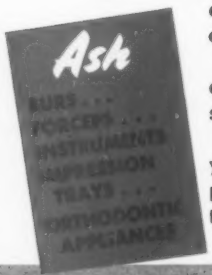

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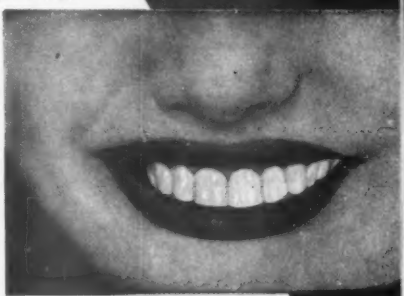

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